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CONTENTS

WEST EUROPE

ADVANCED MATERIALS

New Powder Metallurgy Process From FRG Materials R&D Program
(FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 14 Dec 87)..... 1

Netherlands Makes Superconducting Coil
(PT AKTUEEL, 9 Sep 87)..... 4

AEROSPACE, CIVIL AVIATION

Italian Participation in Paris Air Show
(Antonio O. Ciampi; RIVISTA AERONAUTICA, Oct 87)..... 5

Plea for Autonomous European Space Policy
(W.H. Weenink; NRC HANDELSBLAD, 28 Oct 87)..... 16

Additional Financial Assistance for Fokker
(NRC HANDELSBLAD, 26 Oct 87)..... 19

COMPUTERS

ESPRIT Operating System for Multimedia Workstation Described
(M. Shapiro, V. Abrassimov, et al.; TECHNIQUE ET SCIENCE INFORMATIQUES, 1987)..... 21

Thomson R&D Favors ESPRIT Over EUREKA
(L'USINE NOUVELLE (L'ANNEE TECHNOLOGIQUE)..... 30

Italy's Supercomputer Project APE
(N. Cabibbo; ATA-INGEGNERIA AUTOMOTORISTICA, Jul 87).... 32

Italy's Montedison To Build Fifth Generation Computer
(Mario Schimberni; NOTIZIARIO DELL'ENEA, Sep 87)..... 41

Brain Neurocomputing Projects Announced
(EEC PRESS RELEASE, 19 Nov 87)..... 42

DEFENSE INDUSTRIES

MBB of FRG Develops 'Intelligent' Antitank Weapon
(MBB AKTUELL, Sep 87)..... 45

FACTORY AUTOMATION, ROBOTICS

MBB Assesses Achievements, Objectives of CIM System
(Hans-Oskar Riehm; TECHNOLOGIE & MANAGEMENT, No 1, May 87)..... 47

Elsag's Recent Contributions to Factory Automation
(ELECTRONIQUE ACTUALITES, 16 Oct 87)..... 64

LASERS, SENSORS, OPTICS

Low Loss Waveguiding in InGaAlAs/InP Quaternary Ridge Waveguides Reported
(P. Cinguino, F. Genova, et al.; CSELT TECHNICAL REPORTS, 1987)..... 65

SCIENCE & TECHNOLOGY POLICY

Role of Fraunhofer Association in FRG R&D Community
(Alain Perez; INDUSTRIES ET TECHNIQUES, 20 Oct 87)..... 68

France To Start 'Experimental R&D Tax Credit' in Fiscal 1988
(Marc Chabreuil; L'USINE NOUVELLE, 24 Sep 87)..... 78

France Releases 1984-85 Figures on R&D Financing by Industry
(Gilbert Pointout; INDUSTRIES ET TECHNIQUES, 10 Sep 87). 79

EEC Restructuring Research Facilities To Improve Competitiveness
(EEC INFORMATION MEMO, No P-71, Oct 87)..... 83

Results of EEC's BRITE Competition Announced
(LA LETTRE EUROPEENNE DU PROGRESS TECHNIQUE, 12 Aug 87). 90

Matra Guarding Against Hostile Stockholders
(Jean-Pierre Casamoyou; L'USINE NOUVELLE, 17 Sep 87).... 94

Phase Two of ESPRIT Discussed
(Philippe Moins; ZERO UN INFORMATIQUE, 5 Oct 87)..... 97

Netherlands Government Calling for Increased S&T Budget
(COMPUTERWORLD, 20 Oct 87)..... 100

EAST EUROPE

FACTORY AUTOMATION, ROBOTICS

Use of CAD/CAM at GDR Robotron Factory in Soemmerda
(R. Hesse, E. Hase, et al; FEINGERAETETECHNIK, No 9, 1987)..... 101

LASERS, SENSORS, OPTICS

Poland Uses Lidar To Conduct Lower Atmosphere Soundings
(Andrzej Bielak, Wieslaw Kaszowski; PRZEGLAD GEOFIZYCZNY, No 3, 1987)..... 111

LATIN AMERICA

DEFENSE INDUSTRIES

Brazil's Embramil To Acquire Rocket Technology
(GAZETA MERCANTIL, 30 Nov 87)..... 114

SCIENCE & TECHNOLOGY POLICY

Brazilian Computer Sector Leaders Advocate Restructuring
(Heloisa Magalhaes, Claudia Bensimon, et al.; DADOS E IDEIAS, Oct 87)..... 115

Objections Raised to Privatization of Brazil's Embratel
(INFO, Nov 87)..... 119

TECHNOLOGY TRANSFER

Brazilian Space Cooperation With USSR, PRC
(ESPACIAL, May 87)..... 121

Brazil's SMAR May Sell Automation Equipment to Cuba
(O GLOBO, 16 Nov 87)..... 124

Briefs
Brazilian Participation in 'Informatica Cuba 88' 126

/12223

NEW POWDER METALLURGY PROCESS FROM FRG MATERIALS R&D PROGRAM

36980108 Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 14 Dec 87 p 8

[Article: "Economical Manufacturing Process for Aluminum Alloy Powder: New Applications for Automobile, Aircraft and Space Industries Material Research Program of the Federal Government"]

[Text] Frankfurt--Powder metallurgy represents a special focal point in the material research program of the Federal Research Ministry. Both the atomization process with water and inert gas and rotary atomization of melts belong in the state of the art for a series of alloys. However, for technical or economic reasons the manufacturing processes and the material properties often do not satisfy the increasing demands placed on the current processes. Therefore, the development of current powder metallurgy processes will be combined with the development of new processes for powder manufacture within the scope of the material research program of the Federal Research Ministry.

One research project advocated is concerned with a "Process for the Manufacture and Subsequent Processing of Rapidly Solidified Aluminum Alloy Powder and the Determination of the Material Properties of the Semi-finished Product." The manufacture of extruded products and forged parts with high quality material properties from very rapidly solidified aluminum alloy powders was the goal of this project carried out by Vereinigten Aluminium-Werken AG, Bonn. As indicated by the project leaders, Dr Scharf and Mr Mathy, this technology opens up the possibility for the manufacture of new types of heat-resistant aluminum material. The novelty of these materials consists of their high hot strength, improved fatigue properties and elevated modulus of elasticity.

Therefore, new application areas could be opened up by these aluminum materials particularly in the automobile, aircraft and space industries. According to Scharf and Mathy, one of the problems encountered in this research project consisted in that the so-called hot strength of age-hardenable aluminum alloys is limited by the annealing temperature of approximately 180 degrees Celsius. If the holding time is exceeded, an undesirable loss in strength occurs by over-aging. Then a higher hot

strength can only be achieved by "thermally stable precipitation." A dispersion-hardened, heat-resistant, malleable aluminum alloy can be expected only when the fast-quenched powders exhibit a suitable composition.

In the opinion of Scharf and Mathy, nickel combined with iron is the primary choice for the alloying technique necessary to achieve this since nickel, similar to iron, has practically no solubility in aluminum in thermal equilibrium and also does not lead to a pronounced elevation of the melting point. Alloys with iron and nickel would be advantageous since among other things the diffusion coefficients of these elements are practically the same. Therefore, alloys of the aluminum-iron-nickel system are regarded as especially suitable for the production of dispersion-hardened, heat-resistant aluminum materials.

Gas-atomized powders were used as starting material in the experiments since the gas-atomization method has been developed the most extensively and has been checked in large-scale manufacture. Because the economic aspects for the subsequent processing would be of special importance, the production of round bars in a stationary, cylindrical tool was performed within the scope of the test program to circumvent the current, costly process steps of encapsulation and later removal of the capsules. Both direct and indirect extrusion methods were used for the subsequent processing.

Judged by the experimental results, the dispersion-hardened, heat-resistant aluminum alloy powder on a nickel-iron basis developed by VAW is suited very well as a simplified, economical processing technology. Considerably improved mechanical properties are shown compared to the conventional precipitation-hardened, malleable aluminum alloys. In the opinion of Scharf and Mathy, the developed alloy should permit the processing of relatively coarse powder up to 160 micrometers. The manufacture of extruded powder preforms would be accomplished with specially developed compacting tools and conventional forging presses. This heat-resistant P/M Al alloy could be extruded at temperatures above 400 degrees Celsius without significant coarsening of the structure.

The deformation energy for extruding should not differ significantly at equivalent temperatures; however the maximal extrusion rate should be higher than that for the conventional high-strength, heat-resistant, malleable aluminum alloys. Preformed P/M alloys could be processed further into complicated die-forged parts. The dispersion-hardened alloy manufactured by powder metallurgy as developed by VAW in comparison to the age-hardenable AA 2618 alloys should show comparable strength values at room temperature and the hot strength (hot tensile strength and creep strength) and fatigue strength of the P/M alloys should definitely be better. The modulus of elasticity and the fatigue strength at temperatures up to 300 degrees Celsius should be particularly outstanding with the aluminum-iron-nickel alloy.

In addition, the thermal expansion coefficient should be much lower than with the conventional aluminum alloys. Summarizing, it has been established that the described alloy has produced a new heat-resistant aluminum material whose mechanical properties exhibit distinct advantages compared to the conventional heat-resistant malleable aluminum alloy AA 2618. These properties have been obtained by an economical manufacturing process.

13271

NETHERLANDS MAKES SUPERCONDUCTING COIL

36980056 Rijswijk PT AKTUEEL in Dutch 9 Sep 87 p 3

[Text] During the past several weeks researchers and engineers of the ECN [Netherlands Energy Research Center] in Petten succeeded for the first time in producing usable molds from the new superconducting materials which are presently getting worldwide attention. This is an important step towards practical applications of these special materials. The production technique, developed at ECN, is based on very thin plate or tape material which is still sufficiently flexible and manageable before sintering to make coils from it, for instance. These coils are then sintered and after that, they can be used for superconductivity experiments and tests.

During the past few weeks already several successful demonstration tests have been done in the ECN laboratories, proving the transmission of current in a coil as well as the generated magnetic field. The phenomenon of magnetic shielding by a superconducting plate could also be demonstrated.

This breakthrough in the field of the new superconductors is due to a fortunate combination of ECN's experience with the classic superconductors and the presence of ECN's National Ceramic Workshop where the production technique was developed.

The ECN program with regard to the new superconductors is carried out in close cooperation with the universities of Amsterdam, Leyden, and Twente. The Dutch industry is also following the developments with great interest.

PHOTO CAPTION

1. p 3. A superconducting coil of sintered ceramic material, produced according to the ECN process.

12433

ITALIAN PARTICIPATION IN PARIS AIR SHOW

36980070 Rome RIVISTA AERONAUTICA in Italian Oct 87 pp 60-67

[Article by special correspondent Antonio O. Ciampi]

[Text] Italian participation in the 37th International Aeronautics and Space Show at Le Bourget was, as usual, significant, with a total of 40 of the public- and private-sector member firms of the AIA [Aerospace Industries Association].

The Italian industries occupied a national-exhibits area, the customary "Italy" stand, while planes, helicopters, and weapons and electronics systems were exhibited in the stationary-exhibits area. The Italian industries' presence was enhanced by the nine chalets [Aeritalia, Aermacchi, Agusta, Cirsea e Nardi, Fiat Aviazione, OTO Melara, RSE [Selenia-Elsag Group], Rinaldo Piaggio, and SNIA-BPD) designed to welcome the Italian and foreign guests and operators interested in Italian aerospace production.

This year's Show was very important for the Italian aerospace industry, which, although well-entrenched in fifth position among the world leaders, is undergoing a difficult period. Today, Italian industry is competing against countries such as France, Great Britain and Germany, that have a quite high foreign-market penetration capability, owing in part to the strong political, financial and diplomatic support the industries of those countries receive from their governments.

Despite the problems and uncertainties of the aeronautics market at this particular moment, the Italian industries displayed at Le Bourget '87 a wide range of technologically advanced products that have already met with considerable interest in foreign markets.

Aircraft

This year again, Aeritalia participated with a display situated in the Italian area, a chalet, and five aircraft parked in the stationary-exhibits area: two Tornadoes, a G-222, and two AMX's.

One Tornado, one AMX, and the G-222 also gave in-flight demonstrations of performance, and, in particular, the G-222 took part in the dropping of the parachutists who made daily jumps throughout the aerial exhibitions organized during the Show.

Adding to Aeritalia's direct presence were the chalet of AMX International, the bi-national company that manages the development and commercialization of the Italo-Brazilian plane, and the chalet and stand of the ATR, where the ATR 42 passenger commuter was displayed together with plans for the numerous versions to be derived from it for special uses. One ATR 42 was exhibited in flight, while a full-scale model of the ATR 72--a stretched version able to transport 74 passengers and scheduled to make its first flight in 1989---was shown stationary. It is well to recall that the ATR 42 is already in service with the airlines of 12 countries throughout the world, and that its shining sales success appears poised for a repeat performance also in the case of the stretched version. Its most recent client, the Yugoslav flag carrier Jugoslovenski Aerotransport (JAT), has ordered six ATR 72's (the contract is currently undergoing examination by COCOM, the NATO body that must evaluate the exportability of high-technology products to East European countries). The ATR 72, which will go into production in 1988 at Pomigliano d'Arco and Tolosa, can be considered a predominantly Aeritalia realization, and is one of the best-designed aircraft from the standpoint of construction technologies.

Displayed at the stand were several large-scale models of aircraft in production or under development, including that of the EFA, the future European fighter, which Aeritalia is realizing together with the aerospace industries of the FRG, Great Britain and Spain.

Two other stands were occupied by companies of the Aeritalia Group. The first was Alfa Romeo Avio, to which we will refer further in the portion of this article devoted to the motor industries; the other was Meteor (another company of the Group), which at its Monfalcone plants produces remote-controlled drones designed for various tasks, and which, at its stand, exhibited a Mirach 100 Mizar designed for observation and reconnaissance missions.

Particularly worthy of mention is the first joint presence of Aeritalia and CATIC, the Chinese aerospace industry, which are currently collaborating in the modernization of the avionics and onboard systems of the Chinese A-5M fighter. Displayed at their joint exhibit was an illustrative model of the nose and instrument board of the plane, which contained the principal items of equipment covered by the program: FIAR's P2500 radar, the flow-regulating valve's electronic control amplifier, Microtecnica's air data computer, the head-up display's electronic unit (Selenia), two central computers, the Litton Italiana inertial navigation system, the gyro package, the 3-phase static inverter, and the interface unit.

Notable among the other international programs in which Aeritalia participates are its cooperation with Boeing for the production of the B-767; with McDonnell-Douglas for the MD-80, the new 321-passenger MD-11, and the future

propfan-propelled plane; and the ESA and NASA for numerous space programs. As regards the propfan, the second prototype of General Electric's UDF GE-36 has begun in-flight tests on an MD-80. The first flight took place on 18 May, taking off from the natural runway at Mojave, California, and landing on the Edwards AFB runway, some 30 km away, from which in-flight testing will continue until September.

The MD-80 was modified, much of the aft structure being replaced, to accept the new engine, which was mounted on a large pylon designed and built--as were also the fuselage panels in the zone involved--by Aeritalia, and positioned higher and at a more oblique angle than the plane's normal turbofan, to distance the propellers from the ground. As regards the first prototype, tested on a Boeing B-727, the new propfan features a pair of counter-rotating propellers, consisting of a 10-blade group and an 8-blade group, a configuration designed to reduce noise. It should be noted that the new propulsion system, in the realization of which Italian industry is also involved, should yield fuel-consumption savings of 25 percent over turbofans of equal thrust now in their development phase, and of 40-50 percent over those currently in service.

Aermacchi exhibited at Le Bourget the latest version of its MB-339 advanced trainer (the plane is in service with aviation entities in Italy, Argentina, Peru, Nigeria, Mali, and Dubai). Called the "Digital Avionics" MB-339C, this version, which has already passed the 100-flying-hours mark, is equipped with a navigation and attack system featuring the HUD type of data presentation, integrated with an inertial reference sensor, a fire-control computer and a navigation computer. These features enable more advanced training of pilots in a more realistic manner, and at a lower cost per hour than through the use of more expensive planes.

Flight testing of the MB-339C was divided into three phases: The first phase was devoted to evaluation of the sensors and verification of the data obtained from each system (Doppler, radar altimeter, and inertial platform). In the second phase, the Doppler and inertial platform systems were combined, yielding excellent results, particularly as regards regulation of the Kalman filter. The third phase was devoted to evaluation of the software at an intermediate level, concerning the navigational systems and the presentation of data on the HUD (the latter only insofar as concerns the inherently navigational aspects). The level of accuracy exhibited by the system in this third phase exceeded every expectation, with errors of less than 1/2 mile per hour of flight, even after the execution of low-level tactical maneuvers with estimated-position data.

As concerns the AMX, Aermacchi's activity at this point in time is dedicated to the weapons system tests, which to date have yielded good results. Aermacchi also built the fore section of the fuselage of the first plane for AM and delivered it to Aeritalia in February of this year for the final assembly. The master phasing plan calls for the first flight of the first production-line plane to take place by the end of April 1988, to be followed in

June 1988 by the flight of the first plane to be rolled off of the Aermacchi assembly line. The first flight of the 2-seater version of the AMX, on the other hand, is targeted for mid-1989.

The Agusta Group was on hand at the Show with its A-129 LBH [Light Battlefield Helicopter], A-129 with HOT missiles and SFIM display, A-109K and EH-101 helicopters, SIAI-Marchetti S-211 and SF-600 planes, and the Caproni C-22J. The in-flight exhibitions included the A-129 Mangusta, A-109 widebody, and AB-412 in the rotating-wing sector, while in the airplane sector the spectators were treated to the acrobatics of the S-211 and SF-260 TP.

This year again, the Mangusta stole the show, both as the founder of a family of machines and because of the political and industrial implications stemming from it.

The utility version of this machine (LBH) configured for tactical support, the naval version, and the "Tonal" (the European combat helicopter of the 2000's, with air-to-air, antitank and scout capabilities)--for the development of which an agreement among four industries has been initialed and a company, the Joint European Helicopter company, has been formed, with head office in Rome and capital shares ownership distributed among Agusta (38 percent), Westland (38 percent), Fokker (19 percent) and CASA (5 percent)--will all be derived from the A-129 basic version.

The future of the NH-90, the NATO tactical and naval transport helicopter of the 1990's, on the other hand, is clouded: The program had been launched by Agusta together with Westland, Aerospatiale, MBB, and Fokker, but on the eve of the opening of the Air Show the British Defense Ministry announced its intention to withdraw from the program.

But there are no clouds hanging over the EH-101, the medium-heavy helicopter developed jointly with Westland. After the launching of the Iron Bird helicopter systems test bed at Cascina Costa in January of this year, and the rollout on 7 April at Westland's Yeovil plants, the EH-101 is on its way to becoming a reality.

The Royal Navy has already ordered 50 of these helicopters and the Italian Navy 38, while the British Army has ordered another 25 in the basic version; and the Canadian Government has shown very keen interest in purchasing this helicopter under its ASW-capabilities modernization program. The first prototype has already flown in England, while the Italian one is scheduled to make its first flight some time this year. Meanwhile, the production of prototypes (9 in all) is proceeding according to schedule, towards the industrialization phase of the program.

The program on which Agusta will focus in the future is the convertiplane, which was again talked about at Le Bourget. In this program, which provides for the realization of an aircraft with tiltable rotors enabling it to lift off and land like a helicopter, and to convert mechanically during translational flight to the configuration and characteristics of a purely fixed-wing plane, Agusta's stake is a substantial one.

For the convertiplane, a consortium called Eurofar has been formed in Europe under the Eureka program. The stake of the Italian firms participating in this consortium is 25 percent; and to this stake the Agusta Group contributes 17.5 percent with its Helicopters Division and covers 1.5 percent of the work related to the airplane sector.

With regard to the Agusta Group's Airplanes Division, under which SIAA-Marchetti, Caproni, and IAM [Southern [Italian] Aeronautics Industries] all operate, a state-of-the-art product is the S-211 trainer, which is being used by the Singaporean and Haitian air forces. As of 18 June of this year, the Royal Singapore Air Force's fleet of S-211's in service (since the end of 1984) has logged 10,000 hours of flight time without incurring any significant technical or operational problems.

It appears, moreover, that SIAI-Marchetti and Singapore Aircraft Industries (which collaborates in the production of the S-211's for that country's aeronautical needs) are currently studying a stretched and enhanced version of the S-211, which will probably be powered by a new engine.

Of considerable interest is the agreement initialed during the Show by Caproni and the Canadian company Indal Technologies on a joint development program to increase the operational capabilities of the AB-212 and of other carrier-borne helicopters with skids-type landing gear. This program provides for the design and realization of a system for handling skids-type helicopters aboard ships with maximum safety. Initially, the system will be developed for the handling of the [Italian] Navy's AB-212 ASW's. Indal Technologies will make available its new ASIST system as the basic unit of the management system, and Caproni will design and build the mechanism for interfacing the helicopter with the ASIST unit.

The Italian plane that perhaps scored the greatest success at Le Bourget '87 was the P-180 Avanti built by Piaggio. Everyone at the Show was able to admire the two prototypes of the aircraft as they executed their in-flight exhibition maneuvers--extremely spectacular ones considering that the two planes began their test phase only recently. The first prototype made its first flight on 23 September 1985 and had flown only 135 hours, with 97 take-offs and landings, prior to Le Bourget, while the second prototype flew for the first time only shortly before the Show.

Piaggio expects to deliver the first of these planes in 1989; the maximum productive capacity of its plants for the time being is estimated at 50 planes per year. The Avanti will cost around 3.7 million current lire. Obviously, this figure can vary, and quite considerably, depending on the particular versions and features required by the purchaser (avionics, onboard systems, interior furnishings, etc).

The developing of an innovative plane such as the Avanti during the current crisis can be considered a true act of faith on Piaggio's part in the future of aviation in general.

The worst crisis is the one that has beset the American market, which represents 70-75 percent of the world market and which is considered its litmus paper. The United States' major industries are restructuring their activities. Piper (one of the U.S. giants of the sector) has actually closed its most important plant, and Gates, because of its difficult economic situation, has witdrawn from the Avanti program, in which it was a partner of Piaggio.

Piaggio's Avanti is a passenger transport plane of the executive category, powered by two turboprop engines. It attracted immediate attention, as of its first public appearance, because of its elegant and unique line. This aspect stems from a refined design philosophy which sought to emphasize the aerodynamics of the plane, with a view to maximizing the results from the standpoint of the plane's performance, stability and control characteristics.

The most striking particular ensuing from the complex studies carried out by Piaggio's design staff consists of the small wings situated alongside the nose of the plane. Practically speaking, it is a third wing surface added to the two traditional ones (wings and empennage), producing a positive boost that helps maintain the plane's trim over a wide range of flight conditions.

The use of composite materials in the Avanti is quite extensive, as it is in the most modern planes. Composite materials have been used throughout the nose and the forward winglets, the engine nacelles, the rear hatch, the wing flaps, and the entire rudder and empennage complex. This solution yielded a significant reduction of the plane's weight (empty weight 3,130 kg; maximum takeoff weight 4,767 kg) without reducing its strength.

Electronics, Weapons Systems, Components

As usual, the presence of Italian industry in this sector was notable.

Among the most advanced industries, the Selenia-Elsag Group (9 industries, 18 plants, and around 13,000 employees), of the IRI-STET Group, exhibited at Le Bourget '87 with three of its flagship companies: Selenia, Selenia Spazio, and Vitroselenia.

The Selenia-Elsag Group has an array of product lines ranging from air traffic control systems to ground, naval and air defense systems; from telecommunications satellites to airport installations; from postal automation systems to biomedical equipment; from factory automation systems to industrial robotics.

Selenia, the leader of the Group, exhibited for the first time the mock-up of its Idra, a multi-role missile of the fire-and-forget type, the prototype version of which is currently at an advanced stage of development.

The Idra has a design capability of countering a multiple threat. It is actually a completely autonomous missile that will no longer require the presence of an antenna installed on the launcher and aimed at the target

throughout the missile's entire trajectory as is the case for semi-active guidance systems. Its other salient characteristics are an increased payload range owing to improvements from the standpoint of propulsion, and a greater acceleration capability in its terminal flight phase, enabling it to hit even highly-maneuverable targets. The Idra has a notable antimissile defense capability because it is equipped with a propulsive system that provides it with sufficient acceleration to home in on even the fastest targets.

Selenia also exhibited models of the RAT 31-S/1 long-range tridimensional surveillance radar, and of the Argos 45, a tactical radar that is used for low- and very-low-altitude detection, is highly mobile, and is designed to coordinate weapons systems for the anti-aircraft defense of units stationed on the battlefield.

The Argos 45 can also be used to monitor tactical air support missions and as a gap-filler in air-defense networks.

The system consists of a high-performance radar installed in a single vehicle and including an integrated secondary (IFF) radar. The radar can be linked to an operations shelter that uses a new display family (MAGICS) and a data processing system (MARA).

The model of the MAGICS was exhibited at Le Bourget '87. It is a new family of new-generation displays, designed for command and control applications in naval, terrestrial and airborne battlefield operations.

At Le Bourget '87, Selenia also exhibited a model of SPADA, one of the most advanced Western missile systems for the defense of strategic targets (airports, industries, cities, etc) against very-low-flying aircraft, and of the Skyguard/Aspide system (built by Selenia and by Contraves), which combines conventional artillery and missiles in a single anti-aircraft system. This part of the aeronautics exhibit included a model of the Aspide, Selenia's multi-role missile which is used as an air-to-air weapon and as ordnance in terrestrial and naval systems (including the aforementioned SPADA and Skyguard/Aspide systems), and which has achieved notable export success.

In the production sector devoted to civil aviation, Selenia's exhibits included models of two new planar-type radar antennas, and the DDS/CDS/80 console, a display and presentation system designed for air traffic control.

Selenia Spazio displayed the models of several satellites in the development and realization programs of which the company is currently involved: The Italsat, which is designed for experiments in the telecommunications field and for which the company is the prime contractor; the ERS 1 (remote-sensing oceanographic survey); and the Meteosat (weather satellite).

Vitroselenia displayed a graphics exhibit at the Paris Show, illustrating its activities in the logistics sector. Vitroselenia designs and supplies telecommunications systems, and air-navigation-aid and tactical microwave systems, and, in addition, builds firing ranges.

Interesting also was OTO Melara's participation, even though the company is more involved in the terrestrial than in the aerial sector. The company exhibited at Le Bourget, among other things, the Otomatic--a self-propelled vehicle equipped with the same cannon designed for the anti-aircraft defense of armored units, that has already been analyzed by NATO headquarters with excellent results--and the Sidam, a self-propelled anti-aircraft vehicle equipped with the Oerlikon 25-mm 4-barreled turret.

In the international joint-ventures sector, OTO Melara exhibited a new weapons system, developed jointly with the French industrial company Matra within the ambit of the MILAS [Antisubmarine Warfare Missile] GIE [Economic Interest Group]. Practically speaking, it is an antisubmarine weapon that utilizes as a delivery vehicle the Otomat antiship missile, built by OTO Melara itself, and as its ordnance payload a French torpedo--the Murene--or an A-290 torpedo built by Livorno-based Whitehead Motofides (Gilardini Group).

Referring again to the more exclusively aeronautics industries, Microtecnica was present at Le Bourget with the most significant among the systems and devices developed for the Italian and European aerospace industry's projects.

Indeed, for the EH-101 helicopter, Microtecnica developed the electromechanical actuator system for folding the blades of the main rotor, and the electromechanical actuator for locking the mobile tail-rotor system (with the capability of folding the main and tail rotors, the EH-101's distance to ground changes from almost 23 m to 16 m, thus permitting it to be garaged in medium-sized hangars). The air conditioning system and the transmission-oil cooling system were also developed by the Turin-based company.

For the Piaggio P-180, Microtecnica built the actuator systems for the wing flaps and for the mobile surfaces of the forward winglets, complete with electronic control units, and the heat exchanger for pre-cooling the air of the air-conditioning system.

For the EAP demonstrator, the experimental forerunner of the EFA--the future European fighter plane--Microtecnica developed and produced the actuator system for the leading-edge wing flaps, as well as the heat exchanger, and the air conditioning system's adjustable-setting pressure-pickup and pressure-regulation valve.

Microtecnica is also working, at its experimental center, on the preliminary design of various control systems for the future EFA, such as the primary and secondary flight controls, the air conditioning and heat control systems, the hydromechanical and electronic fuel-regulation systems, the electronic control units of the systems, and various motor accessories.

This year again, the CIRSEA (Aerospace Systems and Equipment Builders Consortium] participated in the Le Bourget Show in force. CIRSEA's membership is comprised of 14 private-sector aerospace industries that employ a total of over 13,500 persons, over 4,000 of whom are specifically assigned to the aerospace equipment sector.

It represents a sizable industrial force that encompasses virtually the entire vast equipment field, ranging from general-purpose equipment to avionics equipment to the space sector.

The member firms of CIRSEA have participated and continue participating in all the Italian aerospace programs, both national and international. Among these we cite the Panavia Tornado in its attack and intercept versions, the AMX, the Agusta A-129 Mangusta and Agusta-Westland EH-101, the Aermacchi MB-339, the ATR-42 commuter (produced by Aeritalia and Aerospatiale), and so on.

Among the CIRSEA member firms, Elettronica S.p.A., based in Rome, exhibited a wide-ranging line of electronic defense equipment at its stand, some of it for the first time. The various items of equipment were displayed with the scale mock-ups of the aircraft for which they were designed. Outstanding among the latter was the Mirage 2000, for a version of which, that is being exported to an Arab country, Elettronica developed a self-protective system based on the ELT/158 RWR [Radar Warning Receiver] and the ELT/558 low-band ECM [Electronic Countermeasure].

For the A-129 Mangusta, Elettronica developed the ELT 554 lightweight ECM, which was shown together with the ELT/156 (V4) RWR, while the MB-339C was exhibited with the ELT/156 (V3) ELT and an ECM pod of the ELT/555 type (the latter was also shown under the wing of an MB-339 in the stationary-exhibits area). Another innovation shown at the Elettronica stand was the self-protective system developed for the AMX and consisting of an ELT/553-type ECM and an ELT/156-X RWR. Also exhibited was the computerized receiver of the radar ESM/ECM component of the Aries electronic defense system operating both at radar and communications frequencies, and used for training and tactical support missions.

SNIA-BPD, in addition to the customary display of its own product line, exhibited the Skyshark weapon dispenser--built by the CASMU Consortium--in the development of which it participated with Aeritalia, the latter being responsible for the activities connected with the aerodynamic and structural design and the guidance and control system.

The Skyshark, which in its basic configuration is of the unpowered type but which is also slated for production in a powered version, has commenced launch tests at the Salto di Quirra test-firing grounds in Sardinia.

For the development of this new system, which from its very first flight appears to have yielded significant results, a number of prototypes will be used to test all aspects of the Skyshark's flight characteristics: separation, efficiency, navigational stability and accuracy.

During the Show, on 16 June, a contract beween SNIA-BPD and Arianespace was signed calling for the Italian firm to supply Arianespace with 10 boosters carrying 9.5 tons of propellant each for the Ariane 4 launcher, and two boosters carrying 7.5 tons of propellant each for Ariane 3.

Motors

Present in the motors section of Le Bourget '87 was Fiat Aviazione, which is currently involved in various international joint-venture projects, relative to production of the RB-199 motor for the Tornado, the building under license of the Rolls-Royce Spey Mk-807 for the AMX, and the startup of the international company that is to develop and produce the motor for the EFA, in which Fiat's share is expected to amount to 21 percent. This motor is to be one of extremely advanced design, with very-high-performance characteristics, and a thrust/weight ratio of 10:1. Its entry into service is targeted for 1995.

Fiat Aviazione's task will be to design, develop and produce the low-pressure turbine, the post-combustion system, and the transmission.

In the civil aviation motors sector, Fiat Aviazione is pursuing a policy of international joint ventures to develop ever increasingly fuel-efficient motors, and is also involved in the programs relative to the propfan engine, which is considered the aeronautical engine of the future.

Fiat Aviazione and Sikorsky are putting together a program for Westland. The British firm, approximately 15 percent of whose capital shares are held by each of the aforementioned companies, is entering upon a vast restructuring program.

The British Government, coming to the aid of Westland at this difficult juncture in its productive situation, recently ordered 16 Lynx medium-weight helicopters, production of which will start immediately, and 25 EH-101's for the Army (in addition to those for the Royal Navy). These orders will enable Westland to resume production at full output rate by 1990.

Meanwhile, Sikorsky and Fiat Aviazione are considering transferring to Westland a part of their activities in connection with helicopters already in production or under development (for example, the American LHX).

Regarding the LHX, Fiat Aviazione, in cooperation with two teams competing for the contract, (Sikorsky/Boeing and Hughes/Bell), is working on the design of the tail-rotor, in respect to which it has already submitted a study and is hoping for a favorable decision by October.

Alfa Romeo Avio, of the Aeritalia Group (IRI-Finmeccanica), participated in Le Bourget '87, displaying a sound internal situation.

The firm is currently devoting a sizable effort to developing its research activities, through participation in international joint-venture programs, including that relative to the CT7-6 (a derivative of the T700-CT7 family), the 2,000-shp [shaft horsepower] motor displayed at the company's stand.

This modern turboshaft, together with the GE T700 from which it derives, represents the highest level attained to date in terms of high specific power and performance, maintainability from the standpoint of time intervals and lower costs, and very high reliability.

Based on a signed agreement among Alfa Avio, Fiat Aviazione and General Electric, the Italian firms participate to the extent of 50 percent (equally divided between them) in the development of the CT7-6, the engine designed to power the EH-101 helicopter and the future NH-90, and to retrofit military helicopters.

Qualification tests of the CT7-6 are to start around the end of 1987 at Alfa Romeo Avio's Turbomachine Test Center, with certification targeted for the spring of 1988. This program ensures adherence to the EH-101 developmental timetable, which is currently being met in perfect accordance with original scheduling, and also ensures absolute interchangeability with the GE T700, which has already been chosen as the propulsion unit for the military as well as civil aviation prototypes of the helicopter.

Alfa Romeo Avio and Fiat Aviazione, which have invested over 80 billion lire in this program, will produce 32 percent of the engines for the entire world market, involving an employment projection of around 600 jobs per year for 15 years, almost exclusively in Southern Italian plants. As regards domestic needs, the two Italian firms, with Alfa as prime contractor, will divide a 70 percent share in the production of the engines; this share can be increased eventually to 100 percent.

This participation in the CT7-6 is the most recent in a series of agreements under which Alfa Romeo Avio has been operating with General Electric since 1977 in programs relative to engines of the T700 family, both from the standpoint of production (Alfa Avio was the first non-American supplier of T700 components for the U.S. Army helicopters, is the licensee for the same engine for the EH-101 program, and is in the process of starting up an overhaul and repair production line), and from that of research (a revenue-sharing agreement with General Electric for the development of enhanced versions of the T700).

Further regarding the research sector, there is the engine program for the EFA. Alfa Avio participates in it both from the standpoint of its design and development and from that of its subsequent production, with approximately a 45-percent share of the Italian participation. In the international joint-ventures sector, Alfa Avio is also involved in the design, development and production of an Auxiliary Power Unit for the EFA.

As regards production, Alfa Romeo Avio has numerous new engine-manufacturing programs in their startup phase. These include the manufacture of engine hot-side components (combustion chambers, turbine blades and disks, etc) for Pratt & Whitney PW JT9-D engines, Rolls-Royce Tay and Spey, Pratt and Whitney of Canada PW 100, etc. Concerning its engine overhaul programs, new production lines are being set up relative to the T700-CT7, the PW JT8-217 for the MD-80, the PW JT3 for the new program relative to the air tanker for the Air Force, and the PW 100 for the ATR 42.

9399

PLEA FOR AUTONOMOUS EUROPEAN SPACE POLICY

Rotterdam NRC HANDELSBLAD in Dutch 28 Oct 87 p 4

[Article by staff writer W.H. Weenink: "Europe Must Keep Ahead in Conquest of Space"]

[Text] "If Europe, where modern technological civilization has its roots, does not exploit its potential by contributing significantly to the conquest of the last empty space still known to mankind, it will renounce its leading role in international politics." This warning opening the first chapter sets the tune of the report entitled "Europe's Future in Space" published today.

In spite of repeated and impressive West European achievements in space (scientific research, the Ariane project), its efforts are lagging behind those of the United States and the Soviet Union. In the short term it is in serious danger of being overtaken by Japan and at a later stage by other rising space powers.

The authors of the report, who are affiliated with five major European research institutes in the field of international relations including the Netherlands "Clingendael" institute, claim that a "continuation of the current policy will probably result in Europe being relegated to the sidelines of 21st-century space policy."

Symbolism

Why has West Europe not been able to develop an efficient joint space policy? Why are European space efforts inconsistent with the technological, industrial, and strategic interests at stake in space and with the human and economic potentials available in Europe?

A possible explanation, according to the report, is that both in the United States and in the Soviet Union the military and people sensitive to symbolism formed the driving force behind space activity, whereas West Europe's space exploration has always had a purely scientific focus. No West European manned space capsules, no West European Apollo project, and therefore no enthusiasm among the European public for their own space effort--whatever the success of scientific satellites. Europe has always lacked the imagination demonstrated by American space travel.

Probably the French were the only Europeans with a clear view on space travel. They have always been the major promoters and go-getters. Without the French there would probably never have been an Ariane project. Unfortunately, their nationalistic sentiments were an obstacle to genuine European cooperation. This of course caused fragmentation and wasted resources. Even after the establishment of the European space organizations ELDO [European (Space Vehicle) Launcher Development Organization] and ESRO [European Space Research Organization] in 1964 and their subsequent fusion into the European Space Agency [ESA], the major countries involved continued to foster their national programs.

Fragmentation also hampered the development of a European space industry. The flaw was the lack of a genuine open market. "Whereas in the United States the highly concentrated national industry benefits from a huge and open domestic market, Europe is burdened with too much duplication among too many competing national units. Too few crossborder industrial links are being established while domestic markets are small and still fragmented," the report states. The free internal market which the European Community intends to realize by the end of 1992 is of vital importance.

Furthermore, European space travel is weighed down with political and industrial fragmentation in military space applications. In the opinion of the research institutes this could entail grave consequences "not only for Europe's long-term security interests but also for the overall technological power and the volume of European space efforts."

The authors are amazed that both West European nuclear powers (France and the UK) have developed separate and independent military programs to set up links in space without cooperation. Furthermore, in 1993 France will launch its own military exploration satellite Helios after a collaboration attempt with West Germany failed.

Autonomy

The report pleads for "a new European consensus" and for "the willingness to put aside narrow national interests both in the commercial and military fields." West Europe should unite to achieve autonomy in space. In the authors' view this means "that Europe should develop the capacity to get into space, carry out actions and activities, and return to earth without requiring the consent of either friend or foe, yet in accordance with Europe's own views regarding what can be benificial to public interest."

Autonomy is clearly distinguished from self-sufficiency. Europe should remain open to international cooperation. Autonomy in space would make Europe a more interesting partner for the United States and enhance its bargaining position in joint projects.

The report recommends that West Europe greatly expands its activities in space. The ESA program will provide "the vital basis." However, a lot remains to be done. Europe will have to build its own ground stations for space systems, an area in which it is lagging behind the United States and the Soviet Union. The successful Ariane project must be further developed. In

addition, Europe should tackle the next generation of space systems: completely reusable transportation systems. This will require more funding than Europe is currently spending on space travel, but with one-fourth of the current U.S. space budget, it would go a long way.

According to the report, European autonomy in space can only become a reality if Europe is able to conduct a common policy in two vital areas: telecommunications and military security. The lack of uniform European telecommunications policy offers the Americans enormous opportunities on the world market. The lifting of protectionist measures within Europe and the deregulation of the PTT's, which are all measures related to the free internal common market for 1992, are indispensable. In the field of military security, Europeans are ill advised to avoid cooperation in space in this field at this very moment. According to the authors this is Europe's greatest challenge: "If Europeans were to take more responsibility for their own security, they simply cannot continue to ignore the use of space."

Thus Europe could build up its own satellite power--of which it is capable--and develop its own data source which could be a useful supplement to the information for which it is as yet dependent on the United States. Furthermore, states the report, such a European gathering of intelligence would be of considerable importance in the "improvement of transparency and prodictability in East-West relations."

Identity

In addition, governments as well as the general public should see that discovering space is an important asset for the political, economic, and cultural integration of West Europe and is a contributory factor to the development of a "stronger European identity."

Before these high goals are achieved, many conflicting national interests will have to be reconciled. And this is the problem in Europe. The report has very good reasons to state that "the biggest threat to Europe's future role in space is the slow and time-consuming decisionmaking process as well as the delays incurred at coordinating and integrating various European activities."

25024
CSO: 3698A057

ADDITIONAL FINANCIAL ASSISTANCE FOR FOKKER

Rotterdam NRC HANDELSBLAD in Dutch 26 Oct 87 p 1

[Article by one of the staff writers: "State Takes 49-Percent Holding: Fokker Gets Another 527 Million Guilders"]

[Text] Rotterdam, 26 October--The Netherlands Government and banks are to invest another 527 million guilders in Fokker. The government's supplementary loan for this year amounts to 212 million guilders. To compensate for new government funding and for part of previous grants (totaling 645 million guilders), the state has now obtained a 49-percent holding in Fokker. Until recently the state had no share in Fokker.

This was announced this morning by Minister De Korte of Economic Affairs in a letter to the Netherlands House of Representatives. Economy experts of the various factions within the House endorsed the agreement reached by the government and Fokker's banks.

The banking consortium doing business with Fokker will increase existing mortgages and current account credits by a total of 225 million guilders. Furthermore, banks will provide a further 90 million guilders for 1988 and 1989.

The 212 million guilders in supplementary government funding were originally intended for Airbus projects in which Fokker is involved. According to Minister De Korte "this depletes the budget for the aircraft industry."

The previous 433-million guilder government grant together with the latest loan will be added to Fokker's guarantee capacity and as such be incorporated in the balance sheet. One hundred million guilders will be converted into capital stock, the remainder is to be entered as a convertible subordinated loan.

As part of the agreement, Fokker will "vigorously seize opportunities for the further cooperation with third parties." The Board of Directors will soon be supported by a financial expert. Until then, the current two managers who have recently been divided on issues, will be assisted by an advisory council "consisting of three persons widely experienced in commercial, technical, and financial matters," according to the minister's letter.

This morning, Fokker spokesman G. Knook refused to comment on decisions made in The Hague concerning the aircraft company. "At the moment we have no further statements on the matter," he said.

25024
CSO: 3698A058

ESPRIT Operating System for Multimedia Workstation Described

Paris TECHNIQUE ET SCIENCE INFORMATIQUES in French Vol 6, 1987, pp 166-169

[Project report presented by M. Shapiro, V. Abrassimov, P. Gautron, S. Habert, and M.M. Makpangou of the French National Institute for Research on Data Processing and Automation (INRIA)].

[Text] 1. Introduction

The project we present here is called "SOS," which stands for "SOMIW Operating System." This is one of the tasks in ESPRIT project 367 entitled "Secure Open Multimedia Integrated Workstation" or "SOMIW" [the other partners in SOMIW are the following: Bull-Transac (France, project leader); Sarin, Italtel Telematica, and CSELT [Center for Telecommunications Research and Laboratories] (Italy); Sobemap and CEN-SCK (Belgium); AEG Telefunken (FRG); and INESC (Portugal)], for the development of a multimedia office workstation, integrated on a network [and intended for] a variety of documents consisting of a mixture of text, graphics, voice comments, animated images, and others. The SOS project consists in the design, for this environment, of an original distributed operating system which, while designed for general use, will be strongly influenced in its design by office requirements. Although SOS will support an incomplete Unix emulation, the underlying philosophy is totally different.

SOS is organized around the "object" concept. A multimedia document can, for example, be seen as a structured set of objects, such as paragraphs, graphics, voice comments, and so on. These different objects are all derived from the same basic category, that of the "textual unit," and therefore they can all be manipulated using the same procedures (cutting, adjusting, moving, etc.), even though their action for each of these procedures may differ radically.

This approach must contribute to the integration of the different development areas in the project. Thus, only one of the [project] partners develops the mechanisms for manipulating the "textual units," which are re-utilized in a document database, an editor, and a pagination system.

The object-based principle is also well suited to distributed systems, because the elementary object is a location unit, with communication being effected between interfaces only. Similarly, it will be seen further on that the object model is well suited to operating systems.

Unlike relatively monolithic systems such as Unix, SOS is an "open" system, in the sense that it is based on a small kernel, with the majority of the system functions being provided outside this kernel. The kernel is responsible only for interrupts, contexts (virtual memory spaces), processes, and communication between contexts. It is completed by system objects, including the managers for the input-output, virtual memory, diskettes and files, naming, distributed communications, etc.

In some existing open systems, such as the V-System or the Chorus-VI, communication is effected through the transmission of messages in a flat address space. We believe that today this nonstructured approach is nearing its limits. The utilization of the "proxy" principle makes it possible to structure communication while at the same time concealing both the protocol and the identity of any eventual partners.

2. An Object-Based System

SOS is an "object-based system;" each visible quantity (process, letterbox, coupler, menu, set of versions of a file, etc.) is an "object," or in other words a black box with a well defined interface. An object is an "example" of a "category," and this category defines its class, its internal data, and its interface. Outside the example, there is no access to its data, which can only be manipulated by calling up the procedures relating to its interface. It is possible to create as many examples of a category as necessary.

One category can be based on another category; while the examples [in this category] will have compatible procedures (the same names and types of parameters), it may have a different internal representation or additional procedures. The derived category is compatible with its "parent category" in terms of type verification.

The SOS system knows neither the internal organization of an object nor the meaning of the different procedures. From the system viewpoint, an object is simply one (or more) segments of data attached to a table of procedures, which itself points toward a compiled code. An object is passive; it becomes active through the calling up of one of the procedures in the relevant table. This makes it possible to utilize the strongly characterized [programming] language C++ for the construction of objects.

SOS itself is designed as a collection of system objects, executed [at a level] above a kernel or an object manager, referred to as a "contact service."

An important characteristic of object-based systems is the fact that the procedural names are generic. In this way, it is possible to access objects with a different construction using the same commands. For example, a file and a letterbox are different objects; the reading code for a file is

different from that [required] to read a message. However, if the file and the letterbox both have (for example) "read" as a procedural name, then a program will be able to access either one of the other in a transparent fashion.

SOS is unlike other object-based systems such as Eden or Cronus, but similar to Apollo Domain, in that it knows the interface of an object; utilization of one object in the place of another is not permitted until the system has determined that their interfaces are compatible.

One of the original features of SOS is that it makes it possible to encapsulate a collection of objects comprised in a given service within a new black box in which the elements, although distributed, cannot be distinguished from the exterior. This is done by making all communications between user and service pass through a "proxy."

3. The Proxy Concept

The "proxy principle" states that, for any operation on a "resource," the user has to call up a proxy, or in other words an object assigned to a user and which, for that user, represents the entire resource. For this user, the only operations possible on the resource are the proxy procedures.

The objects represented by the proxy are called "principals." These are [located] in the contexts or on different machines from that of the user. The sum of the principals and proxies for a given resource form a single distributed object known as a "group."

3.1 Example

In figure 1 we give an example of a distributed electronic courier service. Three slaves--two letterboxes and a delivery slave--in three different locations are involved in this service.

There is no specific user interface, since this is provided by a classic text editor. All that is needed for this to be possible is for the interface to the "courier" service to be the same as the interface of a file; in other words, the editor calls up the same "open," "read," and "write" procedures on a "menu" object as on a "courier" object.

The single interface between the editor and the various slaves in the "courier" service consists of a proxy. In this way:

--The proxy verifies that the user commands are valid;

--It then regroups these commands, replying to them locally when possible by consulting its local data. It may have, for example, a local store of the

most recent messages;

--The proxy then selects a suitable slave to transmit the commands (a choice between active letterbox and delivery slave);

--The proxy communicates with the slaves. For example, it will transform a command coming from the editor to read a record into a message to the active letterbox, [simultaneously] requesting the next message;

--The proxy then regroups the results and displays them to the user. The proxy conceals the complex nature of the distributed courier service, since the user does not need to know either the slave selected or the communication protocol.

Let us now examine this in greater detail. Initially, the editor performs an opening command of the kind "open" ("/my/courier," "read"). The Name Service and the Contact Service (in other words, the object manager) search for a principal answering to this name--in this case "Slave 1." At this point the procedure for generating the proxy of "Slave 1" is called up, and this creates an object (code and data). This object is then transferred toward the user and inserted in the user's virtual memory environment (the rectangle shown with an unbroken line in figure 1); in this way, the object becomes the proxy in relation to the courier service belonging to this user. All that the editor sees of the courier service is its proxy. The operations called up by the editor are local addresses of the visible proxy procedures. For the proxy, on the other hand, the different slaves are visible.

We should point out that the principal can create different proxies according to the opening parameters ("read") and the rights or the identity of the interrogating party. In the example given here, the only messages the party operating the editor is permitted to read are those addressed to that party (and not those addressed to some other party), nor is the party operating the editor allowed to modify these messages.

3.2 Proxy Characteristics

The proxy is a tool for encapsulation, because all the user sees of a resource is the proxy assigned to it. Even more conclusively, the user cannot know the communication protocol between proxy and principals.

In order to ensure that the breakdown of a group canoot be revealed, SOS restricts the possibilities for communication. Communication between contexts (by means of memory sharing, messages, or common files) is permitted only among objects belonging to a given group.

In certain distributed operating systems, such as the V-System or Chorus-VI, resources are accessed by a message transmission primitive, on the basis of an

independent address for the resource location. While this approach has the advantage of being simple, it also has a disadvantage to it, which is that it exposes the internal structure of the services. In the approach employed by SOS, it is not the user who goes to the service (by means of messages), but the service that comes to the user (giving the user a proxy). In this way, all the resources appear to be local and unsusceptible to breakdown. It is clear that the message still remains a necessary means of communication, but only among principals and proxies.

4. Basic Mechanisms

4.1 The Kernel

The objects managed directly by the kernel are the contexts, the processes, the segments, and the object descriptors. These are all described in the following paragraphs.

The contexts are independent virtual memory spaces. An object inserted in a context is referred to as a "contact" of this context.

The system knows the contact through a service descriptor, which acts as an intermediary. The latter contains the following: a pointer toward the first data segment, a pointer toward the table of procedures, and in some cases the reference, known as "trapReference" of an object in the same group, in another context. The trapReference of a proxy designates the principal by default.

A number of processes can be performed in parallel in a given context. Given that the objects are passive, processes are not tied to specific contacts.

4.2 Communication

The basic form of communication is called up indirectly, by a contact procedure, through the table of procedures. Items in this table often point to the code of a procedure of the context, and what we have in this case is a normal procedural command. The item may also contain the intercontext call-up primitive; in this case, the command process continues in another context, calling up the object indicated in the trapReference of its descriptor.

Virtual memory mechanisms are exploited in order to optimize the communication cost between [different] contexts (memory sharing, recopying when writing, etc.).

There are no specific long-distance communication mechanisms, but this is possible via a protocol-type object with access to the network. An object of this kind usually establishes a sort of virtual circuit with its attached pairs to the distant objects in the same group. The default protocol simply extends the intercontext call-up to the long-distance procedural command on a

reliable connection. Other protocols required for specific applications and taken from a protocol file, can easily be substituted for the default protocol, since the protocol remains within the group.

4.3 Dependency Between Objects

In SOS, all the existing relationships between objects are explicit upon execution. In effect, two contexts can only be dependent on each other if the trapReference of one points to the other. Similarly, a relationship between two machines is indicated by a protocol-type object linking them.

This information makes it possible for SOS to maintain a graph of the dependencies between objects. Destruction of an object is automatically signaled to all the objects dependent upon that object. This signal is correctly ordered in relation to the other messages. In turn, the default procedure for processing of a dependence signal destroys the dependent [object]; this procedure can be replaced. By default, principal and proxy are mutually dependent on each other.

The benefits of managing dependencies can be illustrated with an example. Let us suppose that V is an object managing holds on behalf of a second object O. V depends on O. The procedure for processing the signal for destruction of O will release the holds attached to O.

4.4 The Contact Service

The contact service manages the objects, acting together with the kernel. This service maintains information on the objects such as their address, their dependencies, the group [to which they belong], and their trapReference.

The contact service is itself a distributed object. It consists of a "primary" representative in each machine, inserted at the time of initialization of the machine, plus a "secondary" representative in each context, inserted at the time of creation of the context. Each one acts as proxy for the others [this is possible because the underlying system does not differentiate between proxy and principal; the only mechanism needed to put these principles into operation is that of the group]. The secondary contact services are responsible for the contacts of the context to which they belong. When an operation involves intervention by a number of contexts (for example, research or transfer [migration]), it is relayed by the primary representatives of the machines involved.

Insertion of a proxy requires a creation phase [performed] by the principal, followed by a transfer [phase] toward the context of the client. These operations are supervised by the contact service, which first searches for the principal (using a single number), and then, in the context of the principal, calls up its procedure for the generation of a proxy. This procedure returns

the original data segment and a descriptor. These are then transferred to the interrogation context. At this point, if necessary, the code (the reference to which is found in the descriptor) is brought in; the editing of links is performed dynamically. Finally, the object initialization procedure is called up.

5. Current Status of the Project

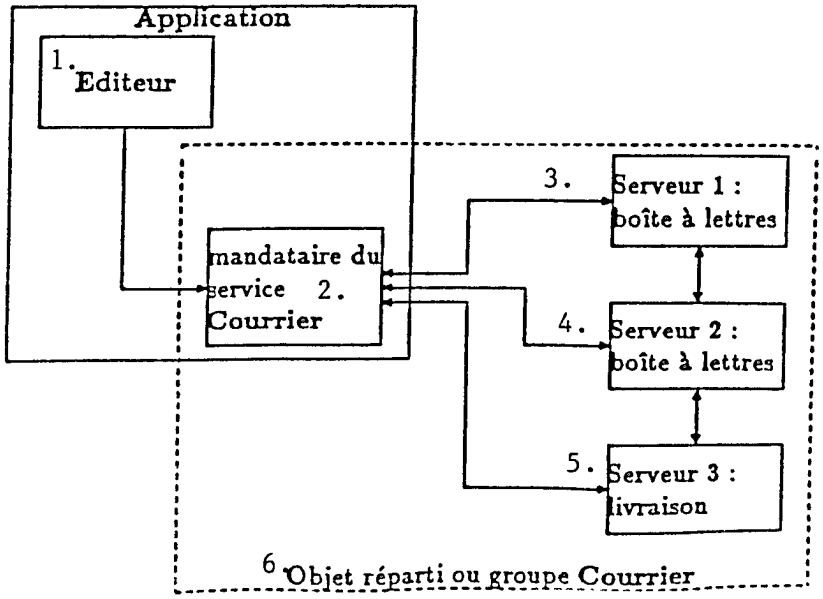
The system is written in the C programming language. It will function directly on the machine; implementation is based on the experience acquired in the Chorus project.

The specifications for system operation have been written. A simulation of the kernel, using Unix, is currently being developed. The contact service works. We know how to load an object and how to perform the dynamic editing of the links. The prototype of SOS operating directly on the machine should be ready by the end of 1987, and the complete system is expected to be ready by the end of 1988.

Modifications are currently being made to the C compiler, in order to integrate the dynamic editing of the links and make it easier to use. Other modifications to the production line are planned, so that it will be possible to verify, at the time a transfer is made, that the interface of the code transferred is fully compatible with the way it is used by the code already present.

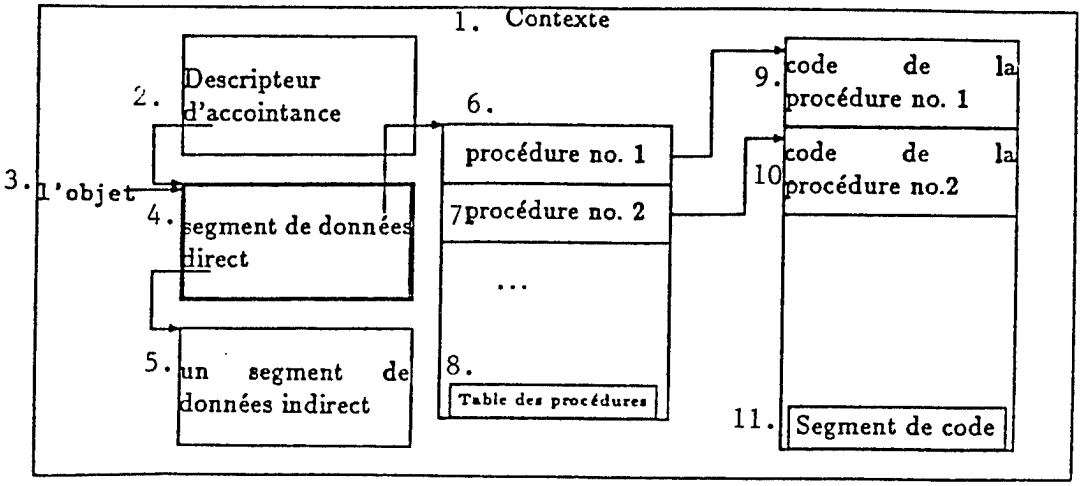
One of the primary objectives of our project is to make it possible to perform different types of tasks simultaneously in a given system, whose sphere of activity ranges from real time activities (voice and animated image transmission) to atomic [atomique] transactions and widely available activities (reliable office procedures). The protocol-type objects will ensure that the different classes of activity will not conflict, while at the same time guaranteeing that the cost of a given activity is limited to the relevant mechanisms. Our future research will be concerned with the development of this facitity.

Figure 1 - A Proxy for a Distributed Courier Service



Key:
1. Editor
2. Proxy of the courier service
3. Slave 1: letterbox
4. Slave 2: letterbox
5. Slave 3: delivery
6. Distributed object or courier group

Figure 2 - Representation of an Object



12. L'objet est connu des applications par l'adresse de son segment de données direct, noté ici *l'objet*. Il est connu du système par son entrée dans la Table des Descripteurs d'Accointance.

Key:
1. Context
2. Contact descriptor
3. The object
4. Direct data segment
5. Indirect data segment
6. Procedure no 1
7. Procedure no 2
8. Table of procedures
9. Code of procedure no 1
10. Code of procedure no 2
11. Code segment
12. The object is known by the applications through addressing of its direct data segment, shown here as "object." It is known by the system through entry in the Table of Contact Descriptors.

8616
CSO: 3698/M147

THOMSON R&D FAVORS ESPRIT OVER EUREKA

Paris L'USINE NOUVELLE (L'ANNEE TECHNOLOGIQUE 1987 special) in French Oct 87 pp 43-45, 47, 49

[Article: "EUREKA: Innovation on a European Scale"]

[Excerpt] ESPRIT or EUREKA: Thomson's Preferences

Thomson, which spends more than 10 percent of its revenues on research and development (Fr 7 billion, of which 50 percent is self-financed), is a devoted follower of the European programs, especially of ESPRIT. Its components division (microelectronics and GaAs), its aviation (optical processor) and tubes (CCD [charge-coupled device] sensors) divisions, its laboratories in Rennes and Corbeville, its subsidiary companies Syseca (software) and CIMSA-CINTRA (artificial intelligence, parallel architectures, symbolic computers...) are all widely engaged in the program. Microelectronics and software represent 95 percent of the group's efforts. Thomson's participation in the program is even greater than that of larger companies like Philips and Siemens. Its teams are indeed involved in one out of every four projects, each of which is being financed for up to 25-30 percent by Thomson (7 percent of ESPRIT I).

Spending Fr 150 to 200 million per year over a 5-year period (about 20 percent of its research budget), Thomson will receive an equivalent sum from the EEC and, most importantly, have access to Fr 2.4 billion in precompetitive research. A good deal!

The French group is considerably less involved in EUREKA. It participates for a total of Fr 400 million in 10 out of the 108 projects--especially the more prestigious projects--retained after the meetings of the European research ministers: The 4-Mbit EPROM memory, the study of submicron-level integrated circuits [IC], high definition television, production of IC's including more than 10 million transistors per chip....

Still, Thomson remains skeptical. Almost 2 years after the program was launched, many projects with the official EUREKA label (within Thomson they speak of nominated, not labeled, dossiers) have not even passed the resource allocation stage. All a government has to do to freeze a project is to drag out budget negotiations or question some of the partnerships already developed (which recently occurred in the UK). Such is not the case for ESPRIT: Each

accepted project is automatically financed at 50 percent.

The relative administrative awkwardness of EEC programs has always been contrasted to EUREKA's flexibility. Maybe mistakenly, because few governments are as generous in allocating public funds to large companies as the French Government.

25039
CSO: 3698/A024

ITALY'S SUPERCOMPUTER PROJECT APE

36980068 Turin ATA-INGEGNERIA AUTOMOTORISTICA in Italian Jul 87 pp 488-491

[Article by N. Cabibbo, president of INFN [National Institute of Nuclear Physics]]

[Text] Why APE

The APE project was launched by the INFN to respond to the need, manifested in many fields of theoretical physics, for a computer combining a high degree of computing power with a large memory capacity. These requirements are voiced in particular by the groups working on digital simulation of some of the recent theories on the structure of the constituents of the atomic nucleus. The digital simulation technique is particularly important for the study of the movement of quarks, the fundamental constituents of the protons and neutrons. We have a theory today of the behavior of quarks--the so-called quantum chromodynamics [QCD] theory. This theory cannot be clarified using the standard methods of mathematical analysis, other than in certain very special physical situations where the results agree closely with experimental observations. To arrive at a more complete verification of the theory, therefore, digital simulation is resorted to, using techniques developed in large part by Italian theoreticians. These simulations require a vast number of computations, and have been carried out, to date, on commercial supercomputers, particularly of the Cray 1 and Cray XMP type. Our Institute currently buys, for this purpose, hundreds of computer hours on Bologna-based CINECA's Cray XMP, while comparable numbers of hours are being used at similar installations in France and England in connection with joint research work. We are nevertheless working very short of the amount of computation needed to fully understand the complex problems posed by QCD. These would require a computing power between 10 and 100 times greater.

It is against this background that the APE project has taken shape, under the impetus provided by a cooperative effort among various INFN units (Rome, Pisa, Padova and the Bologna-based National Center for Analysis of Photograms). The work is being done by a group of theoretical physicists with software and in some cases hardware experience, and by a few experimental physicists with experience in the acquisition of data for large-scale experiments in particle physics, an activity that is highly data-processing-intensive.

The APE project provides for the construction of a computer capable of 1 billion floating-point operations per second [1,000 MFLOPS]. The APE is a parallel computer consisting of 16 computing units, each capable of 64 MFLOPS. Its RAM capacity will be 1 Gbyte. As of the beginning of January, two prototypes will be operational, each comprising four computing units, hence capable of 264 MFLOPS. One of these machines, located at the Rome section of the INFN, was used to start the physics research program, and has operated uninterruptedly without any problem whatever, having logged to date over 1,500 hours of computation. The first scientific paper based on the results obtained to date has already been published. The second machine, located at the Pisa section of the INFN, is currently being used as a test bed for the components to be used in the definitive version, which will be put into service during the summer of 1987.

The cost of the APE project (approximately 1 billion lire) is 1/20 the purchase price of a commercial supercomputer of equal power. The actual cost of an APE 16-unit prototype will run around 400 million lire. The cost of the project does not include the salaries of members of the group, all of whom are INFN employees or university students. The APE cards were designed using CAD systems. The prototypes were built using the wirewrap technology and semi-automatic machines. The definitive versions are being produced by Italian firms using standard industrial methodologies: Multilayer or multiwire cards.

Hardware Architecture

For the APE we adopted the SIMD [Single-Instruction Multiple-Data] architecture. The computing units execute the same code synchronously, instruction by instruction. The data are different for each computing unit, so that each computer executes in parallel with the others a different portion of the overall computation. This structure is the simplest imaginable because it resolves all synchronization problems at their root. A parallel structure of this type is usable for a very vast class of digital problems which includes a good portion of those that pose the heaviest computational demands; that is, conventional field theory (hydrodynamics, and quantum field theory (elementary particle theories) simulations, and molecular dynamics simulations (chemistry, biochemistry, statistical mechanics).

The APE consists of an equal number of computing units (FPU's) and memory units (MU's), interconnected by a switch. In its basic position, the switch pairs each FPU with one MU. The other 15 positions of the switch provide all the circular permutations of the MU's with respect to the FPU's. The result is a ring topology, the simplest for a parallel machine and also the most appropriate where the number of computing units is a limited one.

The computing units are optimized for the complex arithmetical computations; that is, for operations of the type:

$$D = A \times B + C$$

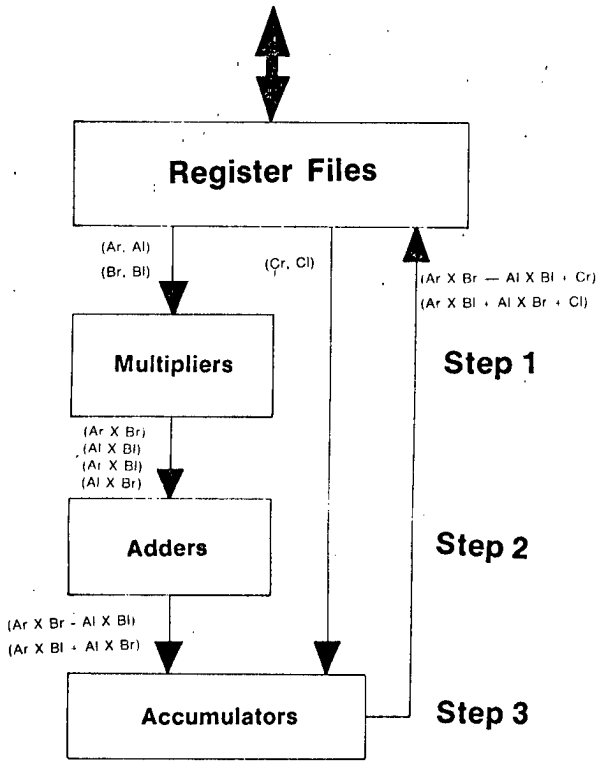


Fig 1 - Block diagram of APE computer.

To realize this operation, the FPU has at its disposal four VLSI multipliers and four VLSI adders (Weltek WTL 1032 and WTL 1033), operating in pipelined configuration. Also available are 64 registers that temporarily store the intermediate computational results. The data traffic to and from the main memory passes through these registers.

The computing unit contains hardware components that facilitate the computing of exp(x), ln(x), $(x)^{-1}$ and $(x)^{1/2}$ functions, and components that enable the realization of the control functions IF...THEN...ELSE, REPEAT...UNTIL and WHILE, which are available in the APE programming language.

Machine Without Microcodes

One of the strategic decisions in defining the architecture of a new computer is the choice of its instruction set. In APE we aimed for the maximum simplicity of hardware, and therefore decided against a microcode-based structure. Our architectural philosophy borders on RISC principles, in that, each instruction takes only one machine cycle. The solution chosen also adheres to the principle of maximum efficiency. To understand why, it is important to note that the operation A x B + C requires 18 cycles, from the moment the first inputted data leave the registers to that in which the results are returned. The operation must be considered as a stream of successive events (see Fig 1). To obtain maximum efficiency from the machine, to be able, that is, to initiate a new operation at every cycle, it is necessary to be able to interweave many of these streams into a single flow of instructions. It is in this regard that a machine without microcodes has a major advantage over those requiring microcodes, as do virually all commercial machines (Cray, Cyber, etc). In such machines the pipeline must be filled by defining specific "vectorial operations." This method is not always applicable, in that, not all operations are vectorizable, and requires voluminous programming (often resorting to assembler language) to attain a significant fraction of the theoretical maximum speed.

In the APE, which is devoid of microcodes, the compiler provides cycle-by-cycle programming and is directly responsible for managing the pipeline. Based on the experience accumulated to date, the high-level programs written in APE language attain a considerable fraction (>60 percent) of the theoretical maximum speed. An example of this efficiency is given in the listing in Fig 2, which shows a fragment of code containing the calculation of a logarithm and one the multiplication product of 3 x 3 matrices. The listing is in performance-analysis format, one of the options available with our compiler: The starting and ending cycles for each line of code are indicated. It will be noted that the compiler has overlapped the computation of the logarithm with the three operations among matrices, a result that is not obtainable with a microcode-based machine, even though equipped with vector functions.

```
0:          0 %integer ka,kb,kc
0:          0 complex u|10000|
0:          0 complex register a#9,b#9,c#9
0:          0 complex static arg,res
41:        56 fast in a#*=u|ka|
53:        68 fast in b#*=u|kb|
71:       171 res=loga(arg)
148:      162 c#0=a#0*b#0+a#3*b#1+a#6*b#2
164:      184 c#1=a#0*b#3+a#3*b#4+a#6*b#5
165:      185 c#2=a#0*b#6+a#3*b#7+a#6*b#8
168:      186 c#3=a#1*b#0+a#4*b#1+a#7*b#2
156:      170 c#4=a#1*b#3+a#4*b#4+a#7*b#5
172:      188 c#5=a#1*b#6+a#4*b#7+a#7*b#8
173:      189 c#6=a#2*b#0+a#5*b#1+a#8*b#2
175:      190 c#7=a#2*b#3+a#5*b#4+a#8*b#5
160:      174 c#8=a#2*b#6+a#5*b#7+a#8*b#8
183:      183 c#0=c#0*res
187:      187 c#4=c#4*res
191:      191 c#8=c#8*res
197:      212 fast out u|kc|  c#*
215:      218 stop
```

Fig 2 - Fragments of code processed by a quantum chromodynamics simulation.

Memory and Switch

The initial version of the machine uses 16-Mbyte memory units consisting of 256-kbit dynamic chips. Its total memory capacity is thus 256 Mbytes. As soon as warranted by market conditions, plans call for substituting this configuration with 64-Mbyte units consisting of 1-Mbit chips (totaling 1 Gbyte).

The memory uses a 64-bit word, and is subdivided into 32-bit memory banks, each provided with an automatic single-error correction and double-error detection system. The memory operates in the vectorial mode and can transfer data at the rate of 1 word per cycle. This rate drops to 1 word every 3 cycles in the case of reading or writing a single unit of data. The transfer rate of the 16 memory units as a whole attains 1 Gbyte.

The memory units are equipped with two access ports: The first communicates with the control computer and is used to load initial data or to transfer the results of the computation. The second port communicates with the computing units via the switch.

The switch consists of custom chips of our own design. It is a separate unit, making the APE architecture completely modular. The same switch can be used to build 8-unit, 4-unit, and 2-unit versions of APE, while a 1-unit APE does not require the use of a switch. With more complex switches APE's could be built with more than 16 units, or with different topologies (planar network, hypercube, etc).

Control Computer

The work of the computing units and that of the memory units are coordinated by a 3081/E control computer, designed jointly by the Geneva-based CERN and the Stanford Linear Accelerator Center. The 3081/E was designed as an emulator of the IBM architecture, and is widely used as an on-line computer in high-energy experimental work, or as a computer for analysis of the data produced in such experimental work. It is a synchronous machine with an 8-MHz clock, which for various reasons was found to be the most suited to our application. The instructions for the FPU are transmitted by a special sequencer. The 3081/E controls the start of the sequencer routines, and is also responsible for all computations relative to the addresses to be sent to the memory units. This is a peculiarity of APE's: Two masters that cooperate in the execution of the program. This situation is illustrated in Fig 3, which shows the interactions between sequencer and 3081/E in a series of read/write operations. The task of synchronizing the two masters is handled by the compiler in a transparent manner to the programmer. This seeming complication enabled a substantial simplification of the project, maintaining intact the structure of the 3081/E. An intensive cooperation developed between the ATE group and the group responsible for the 3081/E. Some of the cards developed for the APE project, particularly the memory units, will be used also by the normal users of this machine.

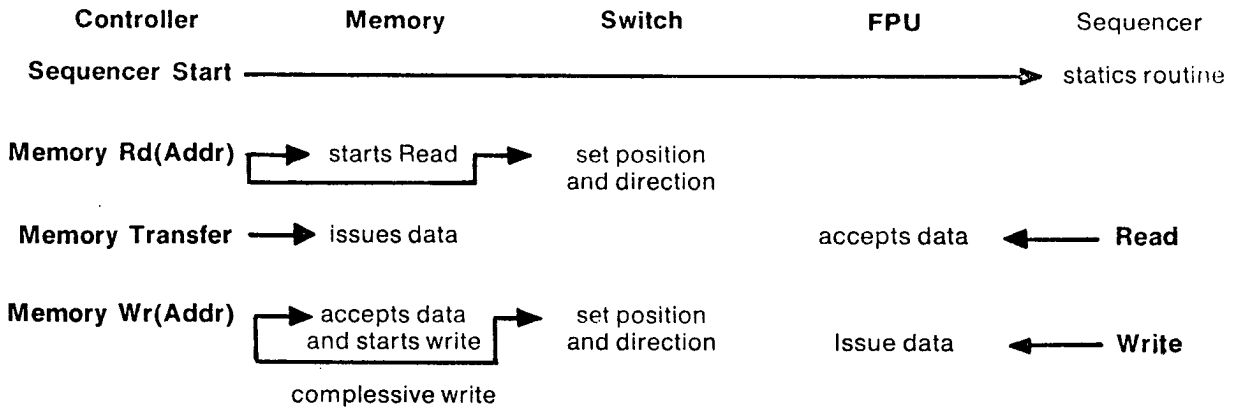


Fig 3 - Flow of controls in APE. In the execution of a routine with floating-point computation, there are two controllers that must work in close synchronism. The control computer transmits instructions both to the memory units and to the sequencer, which in turn controls the operations of the computing units. The control actions are indicated in boldface.

APE for Users

The APE is interfaced with a DEC MicroVax computer via an intermediate controller which follows the standard VME. The APE operating system is integrated with that of the host computer, that is, the VMS. All the system software is written in C and is easily transportable to other operating systems--to the UNIX system, for example. The system software includes the compiler for the APE language, a high-level language similar to structured FORTRAN, and the facilities necessary to the development, testing, and execution of programs. These facilities can be called up interactively or incorporated in programs (DCL, FORTRAN, etc) executed by the MicroVax. The latter mode enables fully automated management of the APE, including periodic reading of the intermediate results of lengthy computations, and their storage on magnetic disk. The first run of computations executed with the 4-unit prototype kept the machine occupied for over 1,500 hours, and required no intervention whatever on our part if we exclude our examination of the results as they accrued, at intervals of several days.

Future Outlook

The APE project, as launched in October 1984, ends with the completion of the 16-unit machine. The machine will offer its users several notable advantages. In a certain sense, its low cost represents a multiplier of its features, which are comparable to those of the best machines on the market today. It is entirely conceivable to dedicate the machine to the solution of a single physical problem, and this is what the APE group, which is directly interested in the simulation of the theory of quarks, intends to do over the next 2 or 3 years. To be able to go from a few hundred to 7-to-8 thousand computing hours a year represents a big qualitative leap in the complexity of the problems that can be addressed, and in the precision with which they can be attacked.

The APE project represents the accrual of a rich store of know-how that will not be lost. It has provided an environment in which young designers of hardware and software have developed their capabilities in a vitalizing and creative atmosphere made so by a perception of participation in an undertaking at the cutting edge of technology, and by the prospects which use of the machine opens for the development of theoretical physics. Discussions wax very lively within the APE group as to possible future projects. The APE got off on just the right foot in 1984, basing its approach on exploitation of the technologies (integrated arithmetic processors, 256-Kbit memories) that would not be available until 1985, and not at reasonable prices until 1986. A new machine should be based on technologies that today are on the horizon: 4-Mbit memories, more powerful digital processors, higher levels of integration combined with technologies for the designing of custom integrated circuits. The outlook is for a machine 10 or 20 times more powerful, and at the same time more flexible. The interest in such a machine would not be

limited to new advances in the understanding of elementary particles. To merely cite an example of great applicatory interest: It could be used to simulate the fluid mechanics about a 1,000-points-per-side cubic lattice, a task that is inaccessible to the most powerful supercomputers available today--APE included.

9399

ITALY'S MONTEDISON TO BUILD FIFTH GENERATION COMPUTER

36980068 Rome NOTIZIARIO DELL'ENEA in Italian Sep 87 pp 81, 82

[Excerpt] Montedison's next venture into a new industrial sector will be "Computer Science." Mario Schimberni, president of the company, made this announcement in Milan on 23 June.

Schimberni announced that through MESA [Montedison Automation Systems Corporation], (the company formed in April 1986, under the heading of the "META Initiative," to concentrate all Montedison's research, production and commercialization activities relative to automation in one autonomous operations organization), "we are about to activate a program for the construction of advanced analytic equipment. Such equipment will comprise, in addition to physical instrumentation, sophisticated machines for processing vast quantities of information by way of special mathematical techniques."

During a press conference, the company's general manager, Angelo Beltrami, explained that Mesa's objective is to develop a fifth-generation computer capable of cataloguing 63 million units of cellular information, with a view to introduce a methodology that might be termed "digital histology."

Pointing out that this is still a very long-term objective, he referred to the initial step, for which it is planned to use traditional computers which will merely be modified. This phase of the research, which will go on for 2 years, will cost Mesa 4-5 billion lire and will require the assignment to it of 7 or 8 researchers.

9399

BRAIN NEUROCOMPUTING PROJECTS ANNOUNCED

Brussels EEC PRESS RELEASE in English IP(87) 488, 19 Nov 87 pp 1-3

[Article: "BRAIN: A Major Step Towards Neurocomputing"]

[Text] The Commission has chosen the first six research projects in a series known as the BRAIN initiative: Basic Research in Adaptive Intelligence and Neurocomputing. This follows recommendations from Europe's leading experts in the field, brought together in the Committee for the European Development of Science and Technology (CODEST), the body which advises the Commission on new trends in science. The projects have been allocated a total of 990,000 ECU.

The purpose of the BRAIN initiative is to support research collaboration aimed at a better understanding of how the brain works, and the design of machines capable of emulating some of its task-oriented problem-solving capacity. This implies finding ways to handle the enormous and simultaneous information-processing capacity (which computers are beginning to possess) and to find ways of developing systems which are capable of active reasoning and learning from experience in the same way as the human brain.

Neurocomputing is a form of artificial intelligence which uses computers with "neural architectures" (an internal structure designed to simulate the nervous system). It is a multi-disciplinary field in which neurobiology joins forces with cognitive psychology, information science, materials science and computer science. Experts believe it is one of the most important and interesting fields of research to emerge in recent years, and constitutes a major scientific challenge with a high potential impact.

BRAIN is part of the Community "Stimulation Action" to ensure a timely and original contribution in this rapidly developing field, so that Europe starts from a position of strength in any future commercial opportunities emerging from neurocomputing. The Stimulation Action has already given the Community a lead in areas such as optical computers and gallium arsenide microchips.

These six projects are as follows:

1) Connectionist Models for Artificial Intelligence

The aim of this project is to develop the computer software and computational methods (algorithms) for various problems in artificial intelligence. This

will be done using "connectionist" models, a mathematical way of simulating the brain's multi-branched (and therefore multi-connected) calculating capacity, and will employ methods developed in neurophysiology (especially for vision and hearing) and experimental psychology.

Research will also be done into the development of learning models using neural networks. These methods will be applied to image recognition, speech recognition and expert systems.

Participants include the University of Paris V, the Centre National de la Recherche Scientifique (CNRS) [National Scientific Research Center] at Gif sur Yvette, the Royal Signals and Radar Establishment at Malvern (UK) and the Universities of Cambridge and Munich (125,000 ECU).

2) Learning in Automata Networks: Towards a Neurocomputing Machine

The aim is to design and build a neurocomputing machine with learning abilities. To achieve this, theoretical studies will be needed to improve learning algorithms for automata networks (software which will allow robots to carry out adaptive learning). The project will also study the application of learning algorithms in signal-processing and artificial intelligence in order to improve their relevance; and will begin to design and build machines after looking at ways to improve existing machine architectures and ways to build neural machines of a significant size.

Participants include six research institutes in Grenoble (France) and the Universities of Dortmund (FRG) and Stirling (UK) (165,000 ECU).

3) Neural Networks for Data Processing

This project will attempt to show that neural networks may be used to perform efficiently and economically some of the tasks which are involved in complex data-processing operations such as vision, pattern recognition and image coding. Research will concentrate on the coding and representation of data, machine architectures and learning and the dynamics of information retrieval.

The partners include groups from the Ecole Superieure de Physique et Chimie Industrielle (ESPCI) and the Ecole Normale Superieure in Paris, together with the Institute for Solid State Physics at the Juelich Nuclear Research Center (FRG) and the Research Laboratories of Philips Ltd (Netherlands) (170,000 ECU).

4) Distributed Matrix Memories

In this project, neurobiology, computer science and cognitive science will combine with the common goal of understanding the computational abilities of neural architectures, especially those which have the same basic connectivity and dynamics of the mammalian neocortex (outer layer of the brain). The idea is to determine at what level of complexity (multiple connectivity) it is necessary to construct a machine so that it begins to function in a similar way to the brain.

The participants are the Max Planck Institute in Frankfurt (FRG) and the University of Stirling (UK) (180,000 ECU).

5) Spatial and Temporal Transformations in the Brain

In this project, researchers will study spatial and temporal (time-related) transformations in the visual and vestibular motor systems of the brain. The real neural networks governing the relation between the retina and eye-movements or head-movements through the part of the brain known as the superior colliculus will be described.

The signals carried in this network during normal or adaptive processes will be compared with predictions made by serial and parallel computer models. Comparisons will then be made with operations in the brain's vestibular system.

The partners are the University of Nijmegen (Netherlands), CNRS in Paris and the University of Zurich (non-funded associate) (150,000 ECU).

6) Graph-Matching Approaches for Invariant Perception

This project will study dynamical connectionist models for pattern recognition; it represents a new theoretical approach to the function of the brain in the form of dynamical connectivity graphs, a particularly useful format for solving problems of invariant pattern recognition.

In this project, two separate teams from the University of Paris XI will collaborate with the Harwell Laboratories (UK) and the Universities of Goettingen and Munich (200,000 ECU).

These six projects bring 28 laboratories and almost 100 researchers into close cooperation under the general objectives of BRAIN. Additional projects to extend these activities will be considered in the near future. The initiative shows once again that, even with limited resources, a great deal can be achieved by sharing expertise at a European level.

CSO: 3698A082

MBB OF FRG DEVELOPS 'INTELLIGENT' ANTITANK WEAPON

Munich-Ottobrun MBB AKTUELL in German Sep 87 p 4

[Text] Ottobrunn--MBB [Messerschmitt-Boelkow-Blohm] is developing the first smart weapons system for the beginning of the 1990's in the form of VBW (vertical on-board weapon). It is used for highly effective AT action by low-flying combat aircraft. The system is autonomous and engages enemy armored formations without target acquisition by the pilot. As a result of vertical engagement, one can effectively strike even at targets with reactive armor. The system is based on the principle of "firing cheap ammunition smartly." This is made possible by modern methods of sensor data processing and new technologies of computer and equipment construction.

The VBW, developed by the aircraft production division of the Helicopter and Aircraft MBB Enterprise group and now undergoing functional prototype testing, is supported by the Defense Equipment Sister Group; it is developing and making high-grade electronic components to make the VBW, an MBB product, a team success.

In addition to the sensors developed by AEG [General Electric Company] and ELTRO, the smart subsystem consists of the three structural components made up of the weapon computer, the firing unit, and the weapon operating unit, which are constructed on the basis of the most modern C-Mos technology. After a development span of only 19 months from the first design up to the completely checked-out finished prototype, the structural components were delivered for system integration which is to be followed by flight testing. This brief production run was possible only because particularly close cooperation with the UL division which derived the algorithms from the overall system requirements and by means of which combined optimum software and hardware concepts were determined.

The weapon computer is the brain of the entire system and works like an expert system in real time. Its job is to perform a sensor fusion of differing sensors and automatically to identify and survey armored targets. The computer generates target data and selects the best weapon tubes for specifically target-oriented engagement. A thorough self-test is an integral part of this structural component. The extreme requirements for data processing and speed were met by means of a special computer architecture. It is based on an asynchronous pipeline structure and is adapted to real-time

algorithms in an optimum fashion. The high computer output thus achieved can be further increased.

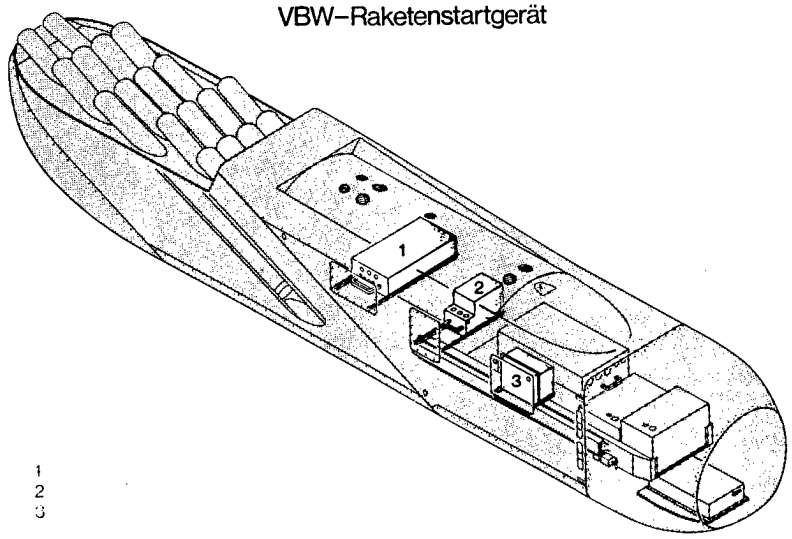
The firing unit is the second smart structural component of the VBW electronic subsystem. The target data generated by the weapon computer are transferred to the firing unit via light conductors and are checked for any possible errors. Depending on the target information and the system status, this unit generates the optimum ignition sequence for the ammunition. A very clever safety concept provides for effective suppression of misfires and for the necessary safety for personnel and weapon carrier.

The weapon operating unit is used for preparing the overall system for different missions and for checking the weapon system with the help of the self-test which is inside the equipment.

The equipment set, developed by the Defense Equipment Enterprise Division for the VBW system, is consistently built with the most modern technology and, in combination with the sensors, for the first time facilitates the automatic engagement of heavy armored vehicles from the air. This means that MBB has taken an important technological step forward which can be further improved in various directions.

In addition to the three-above mentioned key components of the primary system, the Defense Equipment Enterprise Division successfully developed a series of auxiliary and testing units for testing purposes. This includes test adapters, encoders and decoders for measurements in flight and analysis on the ground, and special equipment, such as overflight detectors and data converters.

VBW-Raketenstartgerät



VBW Missile Launch Unit. This x-ray drawing of the VBW missile launching unit for autonomous armor engagement from the air with the electronic structural components developed and made by the Defense Equipment Group for Aircraft Division is another indication of across-the-board cooperation at MBB.

Key: 1. Weapon computer
2. Firing Unit
3. Weapon Operating Unit

5058
CSO: 3698/0097

MBB ASSESSES ACHIEVEMENTS, OBJECTIVES OF CIM SYSTEM

Berlin TECHNOLOGIE & MANAGEMENT in German No 1, May 87 pp 24-31

[Article by Hans-Oskar Riehm, production manager at MBB Ausgburg: Ten years of CIAM at MBB Aircraft Company in Augsburg]

[Excerpts] Ten years ago the fashionable acronyms CAD [Computer Aided Design], CAM [Computer Aided Manufacturing], CAQ [Computer Aided Quality], FFS [Flexible Manufacturing System], etc. still did not exist; nor were the mentality and approach to work represented by these terms widespread. At this time MBB in Augsburg was already developing its own CIAM [Computerized Integrated and Automated Manufacturing] system and, consequently, carrying out pioneering work in the integration and integrated control of the manufacture, storage, and transportation of material and products.

Today almost everyone refers to CAD, CAM, CAQ, and CIM [Computer Integrated Manufacturing], or flexible manufacturing systems. Ten years ago, however, when the Messerschmitt-Bolkow-Blohm-GmbH (MBB) factory at Augsburg created the foundations for the industrial manufacture of fuselage parts for the Tornado program, and of some components for the Airbus family, these ideas were only discussed in technical colleges.

Machine Construction

In order to manufacture highly complex components characterized by consistent quality levels, modern NC [Numerical Control]-cutting machines became absolutely indispensable. Indeed, Augsburg went one step further: since it was possible to start from a widely known production program over a number of years, the decisive step toward increasing efficiency was to be found in an increase in the machine life. The machines were intended to "cut," and downtimes due to preparatory work, changeover of tools and workpieces, swarf disposal, and similar activities were to be reduced to a minimum.

New methods were introduced in machine construction to achieve this goal. In 1976 [the use of] multispindle--the simultaneous working of a number of identical pieces--was a novelty in milling machines as large as those used in aircraft construction. In machine technology, 5-axis NC [Numerical Control] was only just being developed (Figure 3) [not shown]. In this type of machine control the tool does not move only in the direction of the X-Y-Z axis, but simultaneously executes curves at two levels, producing a "stirring" movement.

In this way complex structures can be made in one step without costly resetting [Umspannen].

Peripherals

The efficiency of a modern, optimized machine park of this kind can only be guaranteed if the technical and organizational surroundings are appropriate. By this we mean the peripherals, or the equipment as a whole used to fetch-and-carry, including storage and transportation facilities, as well as the organization necessary for their operation.

Because of this, MBB Augsburg attached great importance to the systematic integration of machines and computer aided, highly automated "fetch-and-carry" systems--the very essence of CIAM.

All machine tools employ DNC [Direct Numeric Control], that is, they are provided with NC programs by a central computer, also responsible for the recording and evaluation of machine data.

Unmanned transportation systems transfer material and devices between each workstation and the intermediate storage points, which are usually operated as automatic or semi-automatic storage units [Hochregallager]. These systems are controlled by process computers; in this way, transportation can be managed either by machine operators or by production control, depending on the organizational situation at each stage of operation, all of which, without exception, is organized according to the workshop structure.

Provision of Tools

A separate system to fetch and carry tools to and from the machines was installed; using this system, automated tool circulation was coordinated with a high transportation rate of up to 15,000 tools per month. This circulation includes:

--Automated storage units [Hochregallager] in which tools are stored according to identification numbers;

--A similarly automated preparation unit for order related combined batches of tools;

--A continuous elevator at every processing machine;

--A tool preparation unit equipped with NC grinding machines and NC measuring machines, in which tools are ground and prepared for their next task;

--A computer-controlled conveyor line for transportation between tool storage and processing machines.

Swarf Removal

The majority of complex components used today in aircraft construction are in fact "fully milled." Cutting grades of over 80 percent are not unusual, and

swarf disposal therefore requires special attention. This is especially true when--as at MBB--the recycled titanium swarf is reused for the manufacture of semi-finished products.

There are separate underground channels for aluminum, titanium, and various other types of swarf, eliminated from the individual machines through grid shafts. Conveyor systems transport the swarf to the appropriate swarf containers. In order to simplify the costly removal of swarf from workpieces, devices, and the worktable, the components of some machines are installed vertically so that the swarf simply drops down into the swarf channels.

Production Control and Computer Structure

Production control has completely new requirements in the automated factory; while the determination of real requirements, capacity planning, development of transactions, control changes, and survey of the stock on hand are still important tasks, they are no longer enough. Production control must also guarantee that the effective NC programs, devices, and tools are in the right place at the right time; it must also ensure perfect operation of automated storage and transportation equipment, or at least have alternative solutions available in the event of breakdowns.

Above all, in the event of a breakdown, it must react rapidly enough to reduce damage to a minimum.

It is impossible to solve this problem by simply increasing personnel.

Instead, MBB introduced a sort of "building block" system for production control with a hierarchical structure of modes.

A central organizational unit determines set requirements, binds batch quantities and administers complete current orders.

The so-called control level carries out breakdown of the manufacturing orders into single work sequences. These sequences are scheduled, work progress is supervised, and priorities established on the spot by the control level.

Each workshop has at its disposal a control unit using organizational and DP [data processing] technical facilities developed for the specific requirements in each type of manufacturing.

The control units are also responsible for operation of the automated fetch and carry systems. These additional tasks offer numerous possibilities for improvement and rationalization of order control.

The control levels are linked through specific interfaces to the central organizational unit. Their connection with production control ensures that in the event of breakdowns during production they do not react in a [theoretically] optimal way, but according to the overall situation of the part manufacture.

The computer interconnection follows the structure principle of production

control. Here also, a hierarchical structure, generally with three levels [as described below] was chosen:

--The central manufacturing computer at the top level supervises the entire production cycle from material distribution to dispatch;

--The central levels are formed by the operational computers, used by the control level for organizational tasks;

--The bottom level consists of an independent control of the separate parts of the system and the directly connected subsystem computers for tasks of equipment control and management.

Figures 5 and 6 illustrate the function of the control unit and the computer network in [the] cutting [process].

The following three systems form the CIAM in Augsburg:

--Numerically controlled machine tools in an optimal layout for integral component production;

--Automated fetch-and-carry systems for workpieces, devices, tools, and swarf, including automatic storage and preparation of tools for cutting tools;

--A hierarchically linked computer system controlling the entire system.

The following is a brief description of the application of the CIAM strategy in different workshops.

Cutting of Large Sections

In the cutting of large sections, frames, spars, and transverse girders [Quertraeger] of up to 5m in length and 2 m in width are prepared. The installed machines have corresponding measurements. The largest portal milling machine has a working capacity of 12m in length and 4m in width.

Transportation of heavy and large parts and devices is performed by inductively controlled unmanned vehicles. These extract the pallets from an automatic storage unit [Hochregallager] and transport them to the delivery stations with which all the machine tools as well as the quality control area are equipped. (Figure 9)

The transport orders are given by the control unit, which in turn is kept informed of the execution of the work sequence by the machine operators via a 2-way radio. Up to six orders can be stored in the system and executed sequentially.

The organizational connection at control level, between work allocation and transport orders, ensures that production control is kept advised of the current work situation at all times.

Cutting of Small Sections

The cutting of small sections was fully converted to CIAM between 1981 and 1984, after the automatic storage and transportation system had been implemented.

Meanwhile, the machine tool industry was acquiring greater experience, thus enabling the construction of the type of machine required by MBB.

Machines were designed which, in terms of the work space [required], the number of moving axes and spindles, as well as spindle performance, were expected to carry out efficiently tasks on small aluminum or titanium parts through milling, rolling, and drilling (Figure 10) [not shown]. Two worktables on which to prepare the next order during working time are usually included.

In later developments of the CIAM concept, the machine identifies the tool before beginning work so that a comparison can be made with the nominal data of the NC program in the DNC computer. Also, on request, the machine operator can effect on-the-spot changes to the NC program.

Parts, devices, and tools are conveyed by an automatic, rail driven, remote controlled transportation system connecting an automated storage unit [Hochregallager], order station, and the main workshop entrance and exit stations (Figure 11).

At the order station, both the parts and the devices and special tools required for the execution of a work sequence, together with order forms and diagrams, are placed in a transport container; production control is then advised that they are ready for allocation. The computer which controls production organizes the tasks waiting in front of a machine into a sequence, using not only their expected terms but also other order characteristics (such as missing parts or vital spare parts) as a guideline; it also optimizes preparation, for example, by grouping together tasks performed by a given device.

Once an order has been executed, the machine operator activates the transportation system from a terminal; the system collects the order and takes it to the order station where it is immediately prepared for the next work sequence. At the same time, the next current order in the waiting list stored in the computer [controlling the production] is conveyed to the machine.

Sheet Metal Preparation

Despite the conversion to the integral construction system, there is still enough swarfless production in aircraft construction to warrant an in-depth study into ways of increasing production.

In particular, small and .medium-sized connecting parts--known as clips--represent a considerable challenge; despite the successes achieved by standardization, the parts still occur in various shapes, and very few parts have the same measurements.

Since 1984 at MBB, different platinum foils have been milled from sheet metal

panels by an NC controlled drilling and milling center; depending on the thickness of the panels, the milling machine can prepare up to 20 panels simultaneously. In addition to the programming of the milling machine, an interconnecting program is also necessary for optimal exploitation of the metal panels and the prevention of waste. [This program] must be updated continuously according to the current requirements.

After milling and grinding [Entgraten], the platinum foils have to be marked before being placed in a computer controlled furnace and exposed to various temperature treatments that vary according to the material [used] and the intended application. After this, they are pressed into their final shape.

This manufacturing process is essentially automatically controlled. If it were carried out in the conventional way, with work documents for each process, the administrative expenditures would be disproportionate to production performance. As far as organization is concerned, there is the additional problem that a variety of different order conditions must be respected, including integration plan, panel stacking, temperature treatment charges, and finally, part number.

Since only three operators for each level are required, this field has been organized as a computer [papierarm] controlled manufacturing center (Figure 12) thus allowing spatial and organizational integration with the sheet metal storage unit (Figure 13) [not shown].

The automatic storage unit for sheet metal panels is located directly in the milling center so that the storage extraction process and machine dispatch process can be combined with no need for extra transport.

Operators move among various workplaces and control the constantly changing work operations in the separate workplaces. Payment is made according to the group contract.

Has Expenditure Paid Off?

The investment decisions for the CIAM project were preceded by in-depth evaluations of the economic aspect. The use of automated, integrated peripherals did not only lead to savings in personnel costs, but also permitted substantial reductions in the number of machines to be acquired in order to carry out the still pending aircraft programs. Taken as a whole, the investment was approximately 10 percent lower than that required for conventional construction with NC machines, even with the additional investment necessary for the peripherals.

CIAM is a closed system, but it has been gradually introduced. The approval for [the implementation of] the following step was not given until the current step had been optimized and the information incorporated in the project.

In this way continual improvement and, of course, continual adaptation to external developments of the suppliers was achieved.

One of these improvements concerned the involvement of operators in the CIAM

project. In the long term, apparently, highly qualified and better educated experts are dissatisfied with performing only supervisory tasks involving highly complex automation. This can lead to demotivation and a slackening off of application.

In order to counteract this development in the CIAM project, operators are intentionally offered the possibility of working on the system, the aim being that operators should make use of the system and not feel that they are a part of the system itself. These possibilities include on-the-spot programming and maintenance of automatic transportation systems as well as the possibility of intervening in the use of [the various] tools.

In machine and plant supervision, MBB has already exploited the rapid progress that has taken place over the last 10 years. While initially it was difficult to find fully tested products available on the market and special developments had to be carried out in conjunction with suppliers, it [later] became possible to introduce high performance and operationally safer control with every conversion step.

From the very beginning, the reliability of each installed system lived up to expectations. However, as everyone knows, the operating response of a complete system composed of a number of closely linked subsystems is, according to the laws of error calculation, substantially lower.

Therefore, within the framework of a systematic revision of the CIAM project, the organizational introduction of a back-up solution to be activated in the whole system in the event of a breakdown of part of the system was ensured.

Increased Machine Use

On the whole, CIAM performance is positive; and this can also be seen from machine usage time in cutting. An increase in production time from 55 percent to 80 percent was planned by using a theoretical system with NC machines and improved conventional peripherals. As early as 1980 a level of 73 percent was reached; a comparable value today would be approximately 84 percent. However, as a result of measures introduced at the same time to optimize production time (for example, an increased cutting speed), the production time rate increased yet again and is now 75 percent (Figure 14).

The technical breakdown rate of the whole system of machines and peripheral equipment was initially 12.5 percent. Through the [process of] decoupling described above, together with [consequent] preventive maintenance and the analysis of weak points, attempts were made to reduce this figure to 6 percent. Today the rate is approximately 8 percent; however, these figures must be considered in relative rather than absolute terms because they depend on the importance of the different within the whole system.

It was possible to achieve--in both normal and emergency operation--an availability rate greater than 99 percent in each system by means of a hierarchical computer structure, and by equipping critical systems with backup systems, as well as strict process linking. In linked operation this rate is, at 93 percent, adequate.

The overall reduction in personnel was achieved through organizational measures in the fetch-and-carry system, especially during late and night shifts; for example, on the third shift, only 50 percent of the operators responsible for large part cutting are present.

Toward the Future

It should be evident that with CIAM, MBB has produced a flexible processing and production control system that not only is capable of dealing with all types of products but can also be adapted to meet a variety of general conditions.

In the Augsburg factory, production is shifting in favor of component manufacture for the constantly expanding Airbus family. In technical terms, this means that the quantity of aluminum processed is increasing, and soon this will also include aluminum-lithium alloys. This will be handled using a higher spindle speed (HSC--High Speed Cutting) and a new dispatch concept.

Given that components are becoming increasingly complex, the capacity of 5-axis machines should be increased (Figure 16) [not shown].

Manufacturing control is faced with a demand for constant adaptation of the production program to market changes and reductions in supplies of materials. In this connection, on-line updating of pending orders and the possibility of changing priorities by means of a computer-aided [system] withstand the test in CIAM.

New organizational measures aim both at minimizing the risks that undermine the advantages of the "Just In Time" approach and at reducing the disadvantages created by small batches [in the following ways]:

--Programs for optimization of set-up times, standardization of devices, and a reduction in the range of tools [required];

--Conversion of the program for quality assurance from controls of single components to process supervision;

--Adaptation of automatic storage and transportation plants to meet increased transportation frequency.

In addition, CIAM offers an excellent basis for the introduction of the measures currently being discussed at a general level for increases in production, such as:

--Expansion of multimachine utilization through supervision with monitors;

--Introduction of a computerized [papierarmen] manufacturing system;

--Further reduction in night shift personnel.

Finally, we must not forget to mention that the NC programming with CAD has already been connected in the preparation stage for a long time. The

production planner checks off the manufacturing details on a screen and prepares them for NC planning without having to repeat the already stored data.

All these measures lead to the establishment of further details for technical and industrial information processing, known today as CIM (Computer Integrated Manufacturing). Initial successes are to be found in the use of the results of NC measurement and tool grinding machines, as well as interpreting automatons for the organization, stock control, and recording of work progress.

After 10 years of application we can now say that CIAM in Augsburg has successfully completed its trial period and that the initial decisions were a sign of courage and farsightedness.

Figure 1: Tasks and Problems Related to the Cutting of Aircraft Integral Components

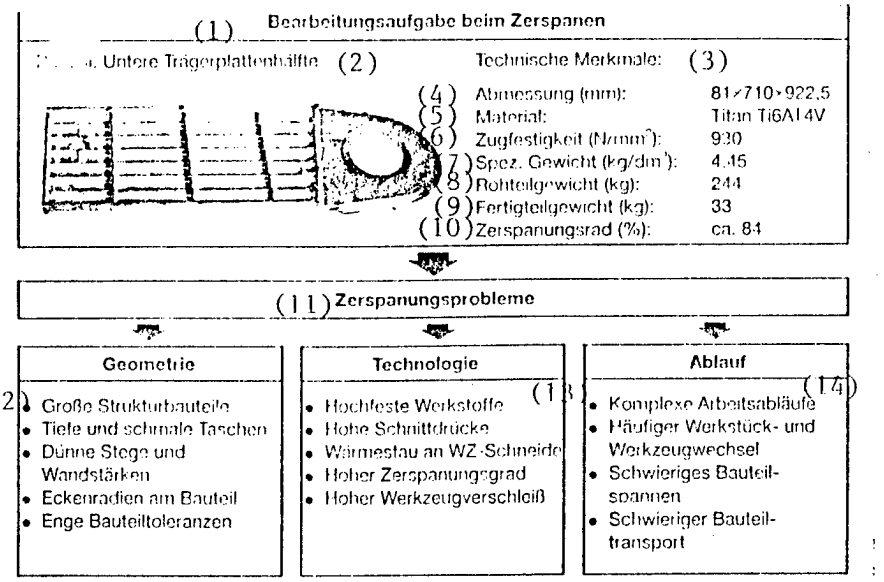


Bild 1: Aufgaben und Probleme der Zerspanung von Flugzeug-Integralbauteilen

1. Processing tasks in cutting
2. Component: Bottom half of carrier plate
3. Technical features:
4. Measurements (mm) 91x710x922.5
5. Material Titanium Ti6Al 4V
6. Tensile strength (N/mm2) 930
7. Specific weight (kg/dm3) 4.45
8. Weight of raw material (kg) 244
9. Weight of finished product (kg) 33
10. Cutting grade (percentage) approx. 84
11. Cutting problems

12. Structure
    Large components
    Deep and small pockets
    Thin webs and wall thickness
    Component angular radii [Eckenradien am Bauteil]
    Low component tolerance
13. Technology
    Highly tensile materials
    High cutting pressure
    Heat accumulation in tool cutting
    High cutting grade
    High tool wear
14. Procedure
    Complex work procedure
    Frequent replacement of workpieces and tools
    Heavy component tension
    Difficult transport of components

Figure 2: Structural Changes in Aircraft Construction

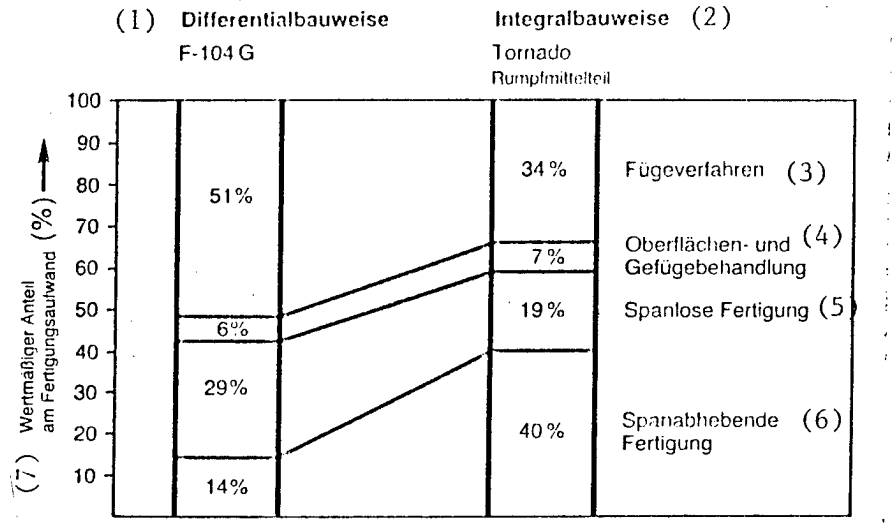


Bild 2: Strukturwandel im Flugzeugbau

1. Differential construction method
2. Integral construction method
   Tornado fuselage components
3. Assembling process
4. Surface and structural treatment
5. Swarfless production
6. Production with swarf-withdrawal
7. Total production share (percentage)

Figure 5: Control functions

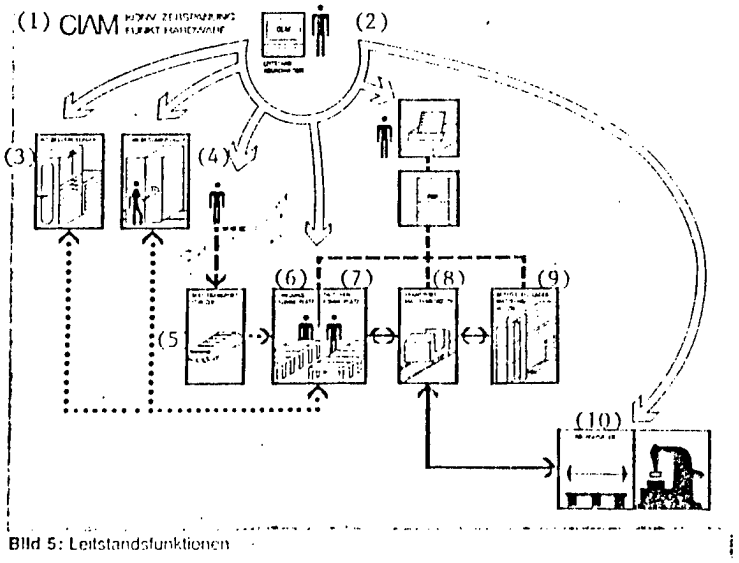


Bild 5: Leitstandsfunktionen

1. CIAM conversion cutting/hardware function
2. OLAF control coordination
3. Tool storage
4. Storage for FEMt [expansion unknown]
5. Material transportation
6. Access to commission area
7. Intermediate commission area
8. Transportation of materials/tools/FEMt/ZN [expansions unknown]
9. Preliminary storage of materials/tools/FEMt/ZN

Figure 6: CIAM Computer-Aided Cutting

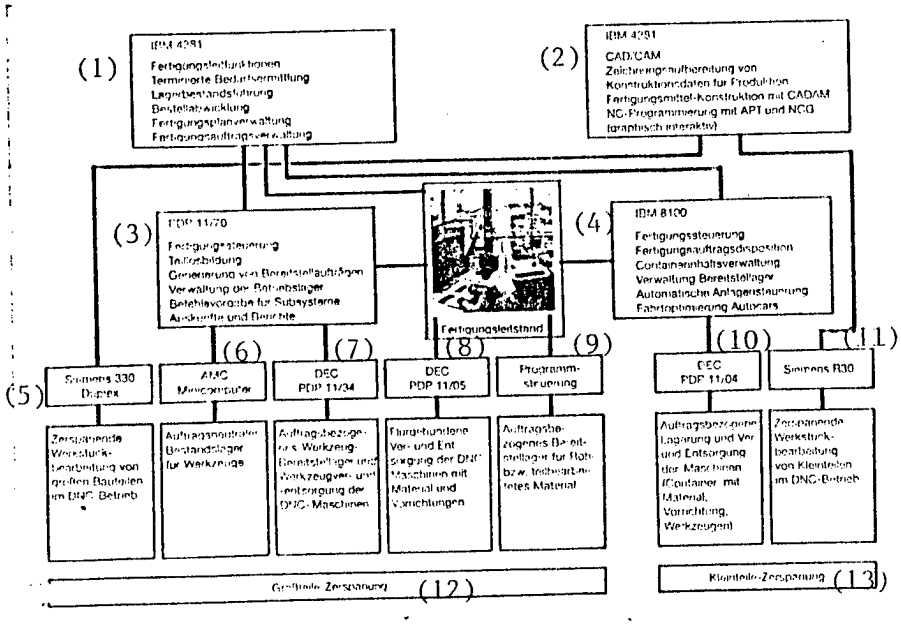


Bild 6: CIAM-Rechnerverbund Zerspanung

1. IBM 4381
   Manufacturing control functions
   Planned transfer of orders
   Storage management
   Order acceptance
   Production plan management
   Management of manufacture orders
2. IBM 4381
   CAD-CAM
   Preparation of graphics related to production data
   Production means - Manufacture with CADAM [Computer-Aided Design and Manufacturing System]
   NC [Numeric Control] programming with APT [Automatic Programming Tool] and NCG [Numeric Control Graphics] (graphically interactive)
3. PDP 11/70
   Production control
   Integral development [Teillosbildung]
   Retrieval of manufacturing orders [Bereitstellauftraegen]
   Storage management
   Assignment of orders for subsystems
   Information and reports
4. IBM 8100
   Production control
   Inventory of manufacturing orders
   Management of container contents
   Management of tool assembly area
   Automatic equipment control
   Travel optimization of vehicles
5. SIEMENS 330 Duplex
   Processing of large components to be cut in a DNC area
6. AMC Minicomputer
   Standard tool storage
7. DEC PDP 11/34
   Storage of available tools depending on the orders [received] and area for fetch and carry of tools to and from DNC machines
8. DEC PDP 11/05
   Floor-based fetch and carry system for DNC-machines for transportation of materials and devices
9. Program Control
   Storage of available raw material or semi-finished material depending on the orders received
10. Storage and transportation to and from machines according to the orders received (containers with material, devices, tools)
11. Siemens R30
    Processing of small components to be cut in DNC-area
12. Large component cutting
13. Cutting of small components

Figure 7: Structure of CIAM System

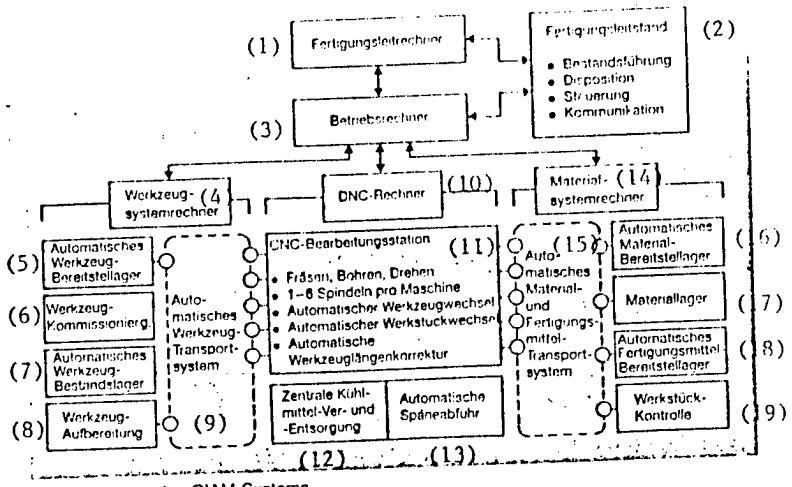


Bild 7: Struktur des CIAM-Systems

1. Manufacture controlling computer
2. Manufacture managing station
   Maintenance
   Inventory
   Control
   Communications
3. Operational computer
4. Computer system for tool [management]
5. Automatic tool assembly area
6. Tool orders
7. Automatic tool storage
8. Tool manufacture
9. Automatic tool transportation system
10. DNC-computer
11. CNC-processing station
    Milling, drilling, screwing
    1-6 spindles per machine
    Automatic tool lenght correction
12. Central provision of cooling agents
13. Automatic swarf removal
14. Computer system for materials
15. Automatic system for materials [processing], production means and transportation
16. Automatic material preparation area
17. Material storage
18. Automatic preparation area for production means
19. Workpiece control

Figure 9: Automatic Transportation and Storage System for Tools and Devices

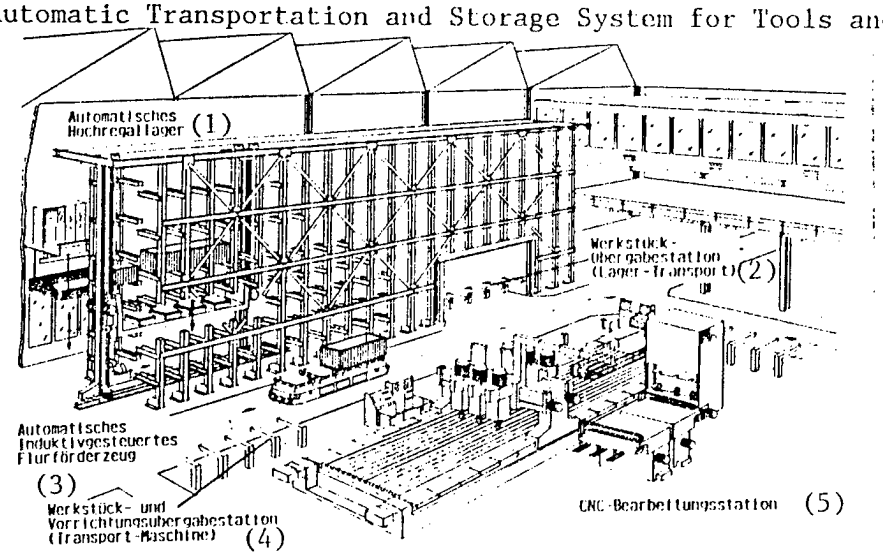


Bild 9: Automatisches Transport- und Lagersystem für Werkstücke und Vorrichtungen

1. Automatic shelf storage [Hochregallager]
2. Tool delivery station (storage, transportation)
3. Automatic inductively controlled corridor vehicles
4. Delivery of workpieces and devices (transportation to machine)
5. CNC-processing station

Figure 11: Transportation System For Small Component Cutting Machines

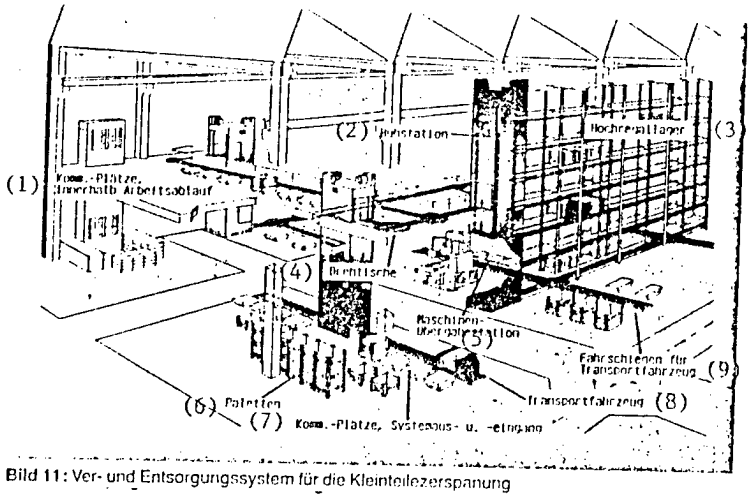


Bild 11: Ver- und Entsorgungssystem für die Kleinteilezerspanung

1. Areas for order acceptance within work process
2. Elevator station
3. Shelf storage [Hochregallager]
4. Revolving tables
5. Machine delivery stations
6. Pallets
7. Area for order [acceptance], system entrance and exit
8. Transportation vehicle

9. Vehicle tracks

Figure 12: Structure of Swarfless Production

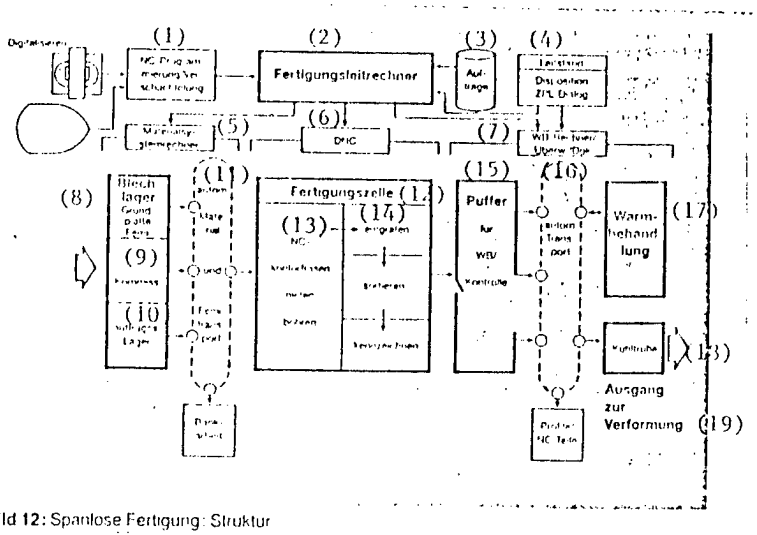


Bild 12: Spanlose Fertigung: Struktur

1. Digitalization
   NC-programming
2. Manufacture controlling computer
3. Orders
4. Control station
   Inventory; ZPL dialogue
5. Computer system for materials
6. DNC
7. WB computer supervision/documentation
8. Lead storage
   Base plates
   FEMt
9. Orders
10. Order storage
11. Automated material and FEMt transportation benchwork
12. Production units
13. NC-contour milling
    Riveting
    Drilling
14. Buring [Entgraten]
    Sorting
    Numbering
15. Buffer for WB control
16. Automated transportation - profiles/NC parts
    Heat treatment
    Cooling unit
    Exit for shaping

Figure 14: Use of CIAM System - Machine Utilization/[Production] time ratio

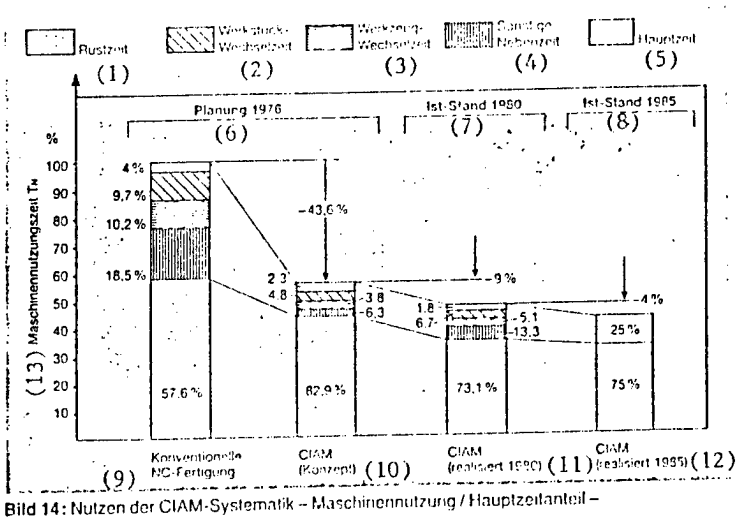
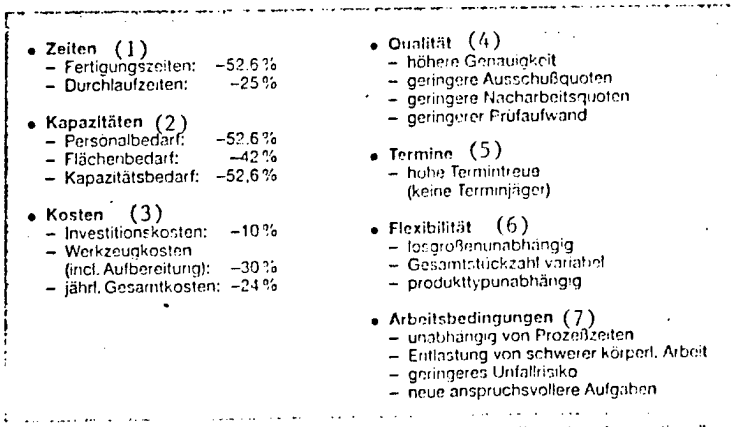


Bild 14: Nutzen der CIAM-Systematik – Maschinennutzung / Hauptzeitanteil –

1. Set-up time
2. Replacement time for workpieces
3. Replacement time for tools
4. Other additional time
5. Production time
6. 1976 Planning
7. 1980 Status [Ist-Stand]
8. 1985 Status [Ist-Stand]
9. Conventional NC-production
10. CIAM [Plan]
11. CIAM [developed in 1980]
12. CIAM [developed in 1985]
13. Machine utilization time

Figure 15: Technical-economic Advantages of CIAM Manufacture Against Conventional NC-Production



- **Zeiten** (1)
  - Fertigungszeiten: −52,6 %
  - Durchlaufzeiten: −25 %
- **Kapazitäten** (2)
  - Personalbedarf: −52,6 %
  - Flächenbedarf: −42 %
  - Kapazitätsbedarf: −52,6 %
- **Kosten** (3)
  - Investitionskosten: −10 %
  - Werkzeugkosten (incl. Aufbereitung): −30 %
  - jährl. Gesamtkosten: −24 %
- **Qualität** (4)
  - höhere Genauigkeit
  - geringere Ausschußquoten
  - geringere Nacharbeitsquoten
  - geringerer Prüfaufwand
- **Termine** (5)
  - hohe Termintreue (keine Terminjäger)
- **Flexibilität** (6)
  - losgrößenunabhängig
  - Gesamtstückzahl variabel
  - produkttypunabhängig
- **Arbeitsbedingungen** (7)
  - unabhängig von Prozeßzeiten
  - Entlastung von schwerer körperl. Arbeit
  - geringeres Unfallrisiko
  - neue anspruchsvollere Aufgaben

Bild 15: Techn.-wirtschaftl. Vorteile des CIAM-Machining gegenüber einer konventionellen NC-Fertigung

1. Time
   - Production Time -52.6 percent
   - Handling Time -25 percent
2. Requirements
   - Personnel required -52.6 percent
   - Space required -42 percent
   - Requirements -52.6 percent
3. Costs
   - Investment costs -10 percent
   - Tool costs
     (including set-up) -30 percent
     Annual total costs -24 percent
4. Quality
   - Increased precision
   - Less waste
   - Less finishing work
   - Lower test-costs
5. Schedule
   Reliable schedule
6. Flexibility
   - irrespective of dimensions
   - variable total number of pieces
   - irrespective of production types
7. Work conditions
   - irrespective of process times
   - elimination of heavy manual labour
   - low accident risk
   - new and more ambitious tasks

08701
CSO: 3698/M100

ELSAG'S RECENT CONTRIBUTIONS TO FACTORY AUTOMATION

36980034 Paris ELECTRONIQUE ACTUALITES in French 16 Oct 87 p 6

[Text] Elsag is taking part in the seventh EMO [Machine Tools Show] at Milan, exhibiting its factory automation activities. Its Elsamate is Elsag's offering as a true approach to factory automation ensuring an orientation towards CIM. Elsamate signifies a "system of automation" at all possible levels, including: multidiscipline-based design and management of orders for the furnishing of the installation; choice of machine tools and other operating units; system electronics and software; infrastructures and installation, integration and startup of the system; post-sale training and support services; all the foregoing on a turnkey basis.

Leading manufacturing companies today are capable of producing in an up-to-date manner, using the Elsa 5000 DNC/FMS system. This system resolves the management and control problems encountered at different levels--distribution of machining programs to all units; collecting of all data tional and production data; management and control of the production system--by way of an interconnecting network linking all the operating units involved. The Elsa 5000 FMS system recognizes, instant by instant, whether the units are usable or not, and their state of utilization; the distribution of the pieces being machined, those coming in and those going out; and the availability of tools and machines. It also enables management of the productive process as a function of orders on hand, in the most streamlined manner possible.

A major laboratory, at the European level, is in its construction phase at the Genoa-based Elsag company, under the heading of EEC-financed Esprit projects, relative to technological innovation. The system is designed to reproduce actual production conditions. Communications with respect to the architecture, which will use Elsa 5000 control systems at the cell level, will be geared to MAP and TOP standards in a multi-supplier environment, open to successive changes.

9399

LOW LOSS WAVEGUIDING IN InGaAlAs/InP QUATERNARY RIDGE WAVEGUIDES REPORTED

Turin CSELT TECHNICAL REPORTS in English 1987 pp 391-392

[Article by P. Cinguino, F. Genova, S. Morasca, C. Rigo, A. Stano, "Low Loss Ridge Optical Waveguides in Quaternary InGaAlAs/InP Grown by MBE"]

[Text]

1. Introduction

The InGaAlAs/InP material system is an alternative to InGaAsP/InP for optoelectronic devices in the 1.3-1.6 μm range for lightwave communication systems. Furthermore, the presence of three cations with almost unity sticking coefficient and of only one group V element greatly reduces the growth problems associated with the Molecular Beam Epitaxy (MBE) growth technique, which is one of the most promising techniques for the production of large area device quality material.

Low loss optical waveguides have been made most in the GaAlAs/GaAs [1, 2] and InGaAsP/InP [3, 4] material systems. Such guiding strucuters are necessary for the development of monolithic integrated optical circuits, where several different optical and electronic devices are integrated into a single wafer.

Recently, Ritchie et al. [5] demonstrated low loss waveguiding in the ternary InAlAs/InP at 1.15 μm wavelength.

In this letter, we report low loss waveguiding in InGaAlAs quaternary ridge waveguides, with loss values comparable to or even better than those obtained in other material systems [1-4], indicating the potential of InGaAlAs/InP for the fabrication of high performance waveguide devices.

(*) Ing. Piero Cinguino, Dr. Fernando Genova, Ing. Salvatore Morasca, Dr. Cesare Rigo, P.i. Alessandro Stano, CSELT, Torino. This paper has been published in Electronics Letters, February 1987, Vol. 23, No. 5 and is reprinted with permission.

2. Fabrication

Most of the work has been realized on layers with an Al content of .17, because this composition, with a bandgap of 1.29 μm [6], is suitable for waveguiding at 1.55 μm.

All the layers were grown in a VG 80H twin chamber MBE system with continuous substrate rotation, provided with an interlock for the fast reloading of the arsenic contained in a cracker cell. Dymeric arsenic was used for almost all the growth experiments. Conventional chemical preparation of the InP substrate and "in situ" thermal cleaning were used [7].

The InGaAlAs layers were grown with a V/III beam equivalent pressures ratio of 20:1, and the growth rates were typically 1 μm/h. All the quaternary layers were nominally undoped, with a net carrier concentration of $3 \cdot 10^{15}$ cm^{-3} (n type). The obtained results have been described elsewhere [8], and will be only briefly summarized here. Device quality InGaAlAs material showed defect densities as low as $2 \cdot 10^{3}$ cm^{-2}, with a 4°K photoluminescence FWHM of 23 meV, which is the state of the art for this material.

Double crystal x-ray profiles showed a FWHM of 17.5″ of arc, demonstrating the crystal perfection of the layers.

InGaAlAs layers 3 μm thick grown on n^+ InP substrates were subsequently made into 1.8 cm long ridge waveguides by chemical etching. A detailed study of the chemical etching characteristics of the layers in the solution of several etching systems was previously carried out [9], indicating the best conditions to obtain nearly perfect waveguide morphologies in order to decrease scattering losses at the ridge walls.

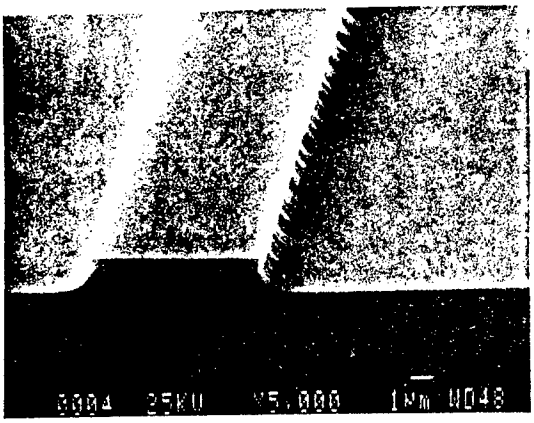


Fig. 1 - SEM photograph of InGaAlAs/InP ridge waveguide.

TABLE I

Number of observed modes as a function of stripe width:
Nx modal order in the direction transverse to the layers
Ny modal order in the direction parallel to the layers.

STRIPE WIDTH (μ)	TE, TM MODE NUMBER Ny	TE, TM MODE NUMBER Nx
17.5	>4	2
7.5	3	2
4.7	2	1 (?)
2.5	1	1
1.3	1	1

The ridge waveguides used in the loss measurements were etched through a photoresist mask with a H_3PO_4:$8H_2O_2$:H_2O solution, which provides an high control of the etched depth, to define structures with a ridge step of 1.5 μm and ridge widths S ranging from 1.3 to 50 μm.

A SEM photograph of the ridge structure is shown in Fig. 1. Under these conditions the external ridge slab was found to be above cut-off for mode propagation.

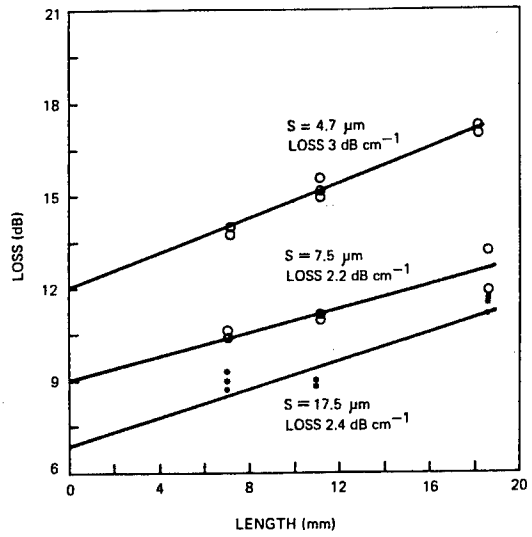


Fig. 2 - Losses as a function of length for different guide width S at 1.55 μm. The coupling losses (Fresnel included), defined for a zero waveguide length, are 7.2, 8.8 and 12 dB for a stripe width of 17.5, 7.4 and 4.7 μm, respectively.

3. Optical characterization

All the waveguides were tested at 1.55 μm using a semiconductor laser butt-coupled to the waveguides by a single mode fiber. The near field pattern at the output face was imaged by a 40 X microscope objective followed by a polarizer on to an infrared sensitive vidicon camera. Table I shows the modal number of the observed guided modes for several widths of the waveguides. As it can be noted, both monomode and multimode operation has been observed. The indicated widths are those actually measured on the structures, in order to take into account mask undercutting [9]. All the waveguides supported both TE and TM modes.

The propagation and coupling losses of the structures were determined by measuring the output power level of different waveguides with the same width and on the same chip. The different waveguide lengths were obtained by sequential cleaving of the chip.

Figure 2 shows the waveguide loss as a function of length for different ridge widths. From the figure it can

be noted that the coupling and propagation losses are different for different guide widths: the former due both to the modal mismatch between fiber and waveguide and Fresnel reflection, while the latter is due to the roughness of the lateral ridge walls which causes scattering losses.

The measured propagation losses for TM modes were about 2.4, 2.2 and 3 dB/cm for 17.5, 7.5 and 4.7 μm widths, respectively.

The coupling losses were 7.2, 8.8 and 12 dB for the same waveguides, including Fresnel reflection losses.

These values of propagation losses are lower than those reported for the InGaAsP/InP material system [3, 4], of the order of 4-6 dB/cm, indicating the high potential of InGaAlAs/InP for waveguide device applications.

4. Conclusion

In summary, we have reported for the first time the demonstration of low loss waveguiding on MBE grown ridge InGaAlAs waveguides, with measured attenuations as low as 2.2 dB/cm at 1.55 μm wavelength.

This identifies the InGaAlAs/InP as a new material system suitable for the development of high performance waveguide devices and for monolithic optoelectronic integration.

Acknowledgments

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ROLE OF FRAUNHOFER ASSOCIATION IN FRG R&D COMMUNITY

36980048 Paris INDUSTRIES ET TECHNIQUES in French 20 Oct 87 pp 51-55

[Article by Alain Perez: "Applied Research: The Fraunhofer Method"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] With its more than 30 centers and over 3,500 persons, the Fraunhofer association of institutes, frequently cited by our masterminds as an example, in effect dominates the West German world of applied research. Its formula for success: Very close ties with industry, a mode of financing based on contracts, traveling-salesman researchers. Still another model of beyond-the--Rhine pragmatism. The Fraunhofer method rests on a simple concept: Development is a product, like any other.

"I won't be winning the Nobel prize this year as yet." Like all other researchers, this Fraunhofer researcher thinks of his career, but his client, the head of a firm, still has an automation problem and it is definitely an urgent one. The contract is almost in the bag. Six weeks of assured work. "Here, a project manager is directly responsible for the financing of the work he heads. He devotes half his time to prospecting for and trying to land contracts. He visits firms and trade shows. We sell development. Basically, it is a product, like any other." Formed in 1949, the Fraunhofer group is growing rapidly. At an annual rate of between 10 and 15 percent. This year, its budget is expected to reach a level of DM560 million, for a staff of 3,550 persons.

With one eye cocked on basic research and the other on the market, squinting now and then has its merits. "We start where basic research stops. In the universities, research tries to produce a few micrograms of a new material. Here, we try to upscale this work to the level of the kilogram or the ton." Hans D. Kunze is the archetype of the director of a Fraunhofer Institute. In his forties, a professor, a doctor of engineering, he heads the Applied Research Institute for Materials at Bremen. "Our idea is to offer to industries a product together with its manufacturing process."

A few principles guide the association as a whole. First of all, a network of 34 highly specialized, small-sized, and sometimes mutually competitive institutes. Most of them are "twinned" with a nearby university whose

research work parallels that of the Institute. Next, a sound mix of small and large contracts. The first of these categories covers contracts (averaging DM30,000 and a duration of a few weeks) which are specifically targeted on very concrete problems, and are aimed at improving an existing product or manufacturing process. The second category covers contracts (with a value upwards of DM1 million and a duration of several years) with large West German industrial groups, or ministries (Research and Defense). These are of an intermediate term nature and are aimed at developing the technologies of the near future. Basic research is not overlooked. Funded by the Federal Government (90 percent) and the regions (Lander), it concerns technologies whose industrial future appears reasonably assured. Each Institute thus has available to it a piggy-bank fund which it is free to invest in projects of its own. The head office in Munich oversees all the Institutes, but concerns itself principally with the drawing up of contracts and the association's overall strategy.

In the main, however, the Fraunhofer group draws on the several advantages of its standing in the West German industrial world. The big industrialists do not hesitate to entrust it with very-high-level projects. Siemens, Daimler-Benz, VW are omnipresent in its laboratories. The Institutes also benefit from the sound health, the power, and... the generosity of the West German machine-tool industry. All their labs are equipped with the latest in advanced production equipment. For the most part, this equipment is provided to them in the form of loans at no charge.

These basic guidelines are further buttressed by a policy of continual mobility as regards its young researchers. The technical universities are a permanent reservoir. Young graduate students come to an Institute to complete work on their doctorates, then leave to go into industry and are replaced by the next group of doctoral candidates. Mobility is also the rule as regards research themes. Once a technique has reached industrial maturity, it is put to bed. If an Institute is unprofitable, it is simply closed or converted. Thus, a few years ago, space activities were judged too aleatory and abandoned. Practically speaking, the Association's interest in a new technology begins at the point where the latter is ready to progress beyond the research laboratory stage. The Association's involvement covers everything that can be expected to take place between tomorrow and 10 years hence.

To balance its budget, each Institute applies the 3-thirds rule: One third official contracts, essentially with the BMFT [Ministry of Research and Technology]; one third industrial contracts; and one third plowed-back earnings. So much for the overall principles. At the detail level, each Institute exercises its own autonomy and protects its own reputation. As a result, every visitor is received as though he were a potential client: coffee, a presentation on the Institute's activities, video, on-site visits, American-style chats. Many industrial projects are confidential. However, this does not translate into an obsession with defense-type secrecy.

The Fraunhofer Institutes

Location by Fields of Specialization	1987 Staffing (No. of Persons)	1987 Revenue (DM Millions)
Production/Automation/Sensors:		
Karlsruhe	201	22.7
Stuttgart	158	21.3
Darmstadt	110	15.7
Stuttgart	90	13.9
Dortmund	74	10.5
Freiburg	77	8.2
Stuttgart	24	3.0
Methods/Energy/Mechanical Construction:		
Pfinztal-Berghausen	168	15.4
Stuttgart	87	8.4
Munich	81	6.7
Freiburg	65	6.9
Stuttgart Holzkirchen/OBB	107	11.4
Stuttgart Braunsweig	76	6.7
Environment:		
Hannover	148	13.9
Schmallenberg	90	7.9
Garmisch Parten Kirchen	65	5.7
Microelectronics:		
Freiburg	139	14.4
Munich	98	12.1
Berlin	84	12.4
Duisburg	63	5.2
Erlangen	40	5.6
Materials and Components:		
Aix la Chapelle	80	7.6
Aix la Chapelle	61	5.6
Darmstadt	99	10.2
Saarbrucken	120	14.6
Freiburg	72	7.6
Freiburg and Weil am Rhein	135	11.6
Bremen	85	8
Wurzburg	82	5.7

* [Above data provided by source in graphic form]

Number of Researchers by Sector (1987)--Not including Temporary Researchers (Students)[*]

Sector	Researchers
Materials and Components	500
Automation of Production	410
Microelectronics	380
Environment	360
Industrial Engineering	350
Information Technology	290
Energy/Construction	250
Production Technologies	210
Scientific and Economic Studies	180

* [Above data provided by source in graphic form]

Let us start with Berlin's two Institutes and their colossal facilities: The IPK [Production Systems and Mechanical Construction Technologies] and the Institute of Microstructural Techniques. The first of these is dedicated to manufacturing processes and methods. The second, to microelectronics. These two are prime movers in the Fraunhofer organization. In all, five Institutes work on microelectronics (Friburg, Munich, Berlin, Duisbourg, Erlangen). Eight are in charge of everything having to do with production techniques: Automation, flow management, production techniques, work organization and methods, etc...

Born in Munich, aged 45, and also a professor at the University of Berlin, Anton Heuberger heads the microstructures Institute. He is an unshakable partisan of applied research. "In the FRG, we spend too much money on basic research. Currently, everyone is concentrating on superconductors. That's the problem with basic research. It is unable to escape the influence of what's in vogue. Here, there is no such danger. We live on our results. Like a commercial firm. We number some 100 persons. That's the ideal size." The facilities available to this R&D PMI [Small- and Medium-Sized Industry] are nevertheless unique in Europe. They include an 800-MeV synchrotron for the submicronic etching of silicon wafers. "Our job consists of demonstrating the feasibility and economic viability of technologies of the future. X-ray lithography is the best solution for fabricating the circuits of the 1990's on an industrial scale. Of course, no industrialist has the money to pay for a synchrotron like the one we have here. But we are also working on a more compact one that can be used by industry." The Institute dates back to 1985. It was installed next to the existing synchrotron (Bessy) financed by the BMFT and representing an investment of DM100 million by the BMFT to make Berlin a research capital. The Institute makes use of this source of energy (one fourth of the time) and pays its share of the annual cost of its use (DM 1.5million).

"This technique offers several advantages over optical lithography," explains Anton Heuberger. "It should enable us to attain a resolution of 0.1 µm. But this is not the most important of its advantages. We also have a greater depth of field and can therefore etch circuits in 3 dimensions. We can also produce larger-sized circuits since there are no lenses or beam-focusing problems to deal with. Moreover, this system is less sensitive to dust. X-ray lithography will be indispensable for the low-cost manufacturing of 64-M DRAM's. It is quite easy to produce memories in the laboratory with etchings a few tenths of a micron in width. The real problem lies in the quality and consistency of the manufactured product. We'll be working on this technology until 1990. Thereafter, industry will take over and we'll go on to something else. We're barely at the inception of microelectronics."

The industrial partners comprise the mainstay of this program: Siemens, Philips, Telefunken, Eurosil. "Fifteen researchers from Siemens are working with us on a full-time basis. We're actually at risk of becoming a sort of subsidiary. But we are careful to protect our autonomy." A new tool is in the process of being installed: A 630-MeV, 8-beam, compact (4m x 2m) synchrotron christened the Cosy MicroTEC. It is targeted for an in-service date

of May 1989, and is expected to enable etchings as small as 0.3 μm at an industrial output rate (60 wafers per minute). This source perhaps prefigures the production of the semiconductors of the 1990's. Not only for the manufacture of circuits. Also envisioned is the production of integrated sensors (temperature, pressure) obtained directly by etching in 3 dimensions. "The 1990's will continue to be silicon years. At present, I don't foresee a bright industrial future for AsGa's over the near term." With its five divisions, the IPK is dedicated to production (automation, mechanical construction, methods, numerical control). It has a budget of DM15 million for this year, over DM7 million of which represent industrial contracts. "We must present our clients with a finished product. Not just a design study on paper," says Gerard Duelen, who heads its Automation Department. The Institute was installed last year in a brand new building. It was planned on a big scale. A test hall 64 m in diameter is already full of machines and robots. Across the street is a university that specializes in machine tools and machining techniques (IWF). Relations between the two are on an ongoing basis. A number of professors teach in both the Berlin Institutes. "We operate like a plant. We work all year round. For the managers, it's 12 hours a day," continues Gerard Duelen, a Belgian, 61, whose entire career has been in automation.

Latest Advanced Equipment Throughout

The equipment that has been installed is impressive. "There are all of some DM50 million of machine tools in place. Most of them have been lent to us by industrialists. But we do developmental work for their account. Often, they turn prototypes over to us even before commercializing them. We then complete the development and programming of these prototypes. Afterwards, they leave the machines with us at no charge for several months. The advantage of this arrangement is that we always have the most modern machines. In addition, we invest between DM1 million and DM1.5 million each year in new equipment."

Thus, one finds in the shop 3 Krupp presses (furnished by VW) on which work is being done to develop a program for controlling tool pressures so as to improve the quality of stampings. One also finds 3 NC lathes (Traub) equipped with simulation. While one piece is being machined, the fabrication of the following one is being simulated on a screen.

It stands to reason that the IPK lands very-high-level contracts. VW's robotized windshield-bonding system was developed here. The same thing is currently being done for Audi. "Our smallest contracts are on the order of DM300,000; our biggest ones, DM1 million. We analyze the problem that is given to us and estimate the work time involved. We assign one student to work on each project. But we accept only projects corresponding to our line of research. As of now, we have many projects involving automated assembly and all the sensory transducer techniques. Thus, the IPK is working on a telex-machine assembly line (for Siemens) designed around four robots all working at the same time. It conducts tests with lathe spindles made of carbon composite, and on parts-trimming systems with two synchronized robots.

"But not everything can be robotized. Volkswagen has attained a robotization level of around 25 percent of its overall assembly operation. But there are still many German enterprises that cannot automate any further because technicians can no longer be found to operate the machines. It's a real problem."

At Stuttgart, the IPA [Institute of Production Techniques and Automation] pursues practically the same objectives: Automation, machine controls, surface conditions, quality. As a European pioneer in robotics, its reputation now extends well beyond the FRG's boundaries. Thanks to a boss of considerable standing: H. J. Warnecke. The IPA, with its 160 full-time researchers and 400 students, is one of the Association's most important Institutes. As is the case in Berlin, it has an impressive array of robots (25), made available to it by the builders. Rainer Schanz, engineer, aged 30, and head of industrial robotics activities, is the very example of the Fraunhofer young researcher. During the day he works on advancing the obtaining of contracts and on canvassing industrialists. At night he works on his doctorate. "We are free to publish the results of our work, but in some cases the industrialist concerned prohibits us from publishing certain details." Once he has earned his doctor's degree in engineering, he will go into industry. That is, unless the Institute makes him an interesting offer.

Here too, a quasi commercial structure has been put in place. "At most research institutes, it takes 2 to 3 weeks to reply to a letter," says Ernst W. Bergner, head of administration at the IPA. "Here, we have a small client-assistance service. We reply to a request the same day we receive it. That makes a good impression on the client." "We try to mix small and large contracts, between DM40,000 and DM1 million to DM2 million. The small contracts enable us to maintain contact with the medium-sized firms. One month of an engineer's work costs DM17,000."

The IPA applies three types of tariff. The most frequent case is the fixed-price contract. The Institute and the industrialist agree on an objective and a time period. The second option is an a-la-carte system. Successive items of work (and their prices) evolve with time, depending on interest in the results obtained. The third option is the putting up of capital for research into subjects on a "just to see" basis at the risk of the client. All contracts are administered by the central office in Munich.

"In the production engineering sector, it is essential that we have modern equipment at all times. Machines more than 3 years old are useless to us. When they are more than 5 years old, we can't even sell them as used equipment." Ernst Bergner speaks like the head of a business enterprise. The IPA is also working on several ambitious longer-term projects: An automatic machine for handling fabrics to feed a garment-manufacturing flexible workshop; automatic mounting of rubber connecting-hoses on automobile radiators and expansion reservoirs (for the account of the BMFT); automatic wiring of electrical harnesses; and a number of complex operations requiring sensory transducers, cameras, and accurate, fast robots.

While Berlin seeks to strengthen its position as a city of high-technology, Bremen is undergoing a crisis in the heavy industries. The situation is very bad for the steelmaking and shipbuilding sectors. Bremen is where the IFAM [Institute of Applied Research on Materials] is located, with some 100 specialists and as many students, who are there to work on their doctorates. "We concentrate our efforts on value-added-intensive materials," says Hans D. Kunze, who heads the Institute. "What interests me is exceptional materials costing DM1,000 per kilogram. The aeronautics industry is prepared to pay that price. When we're ready, we'll go see the industrialists and say to them: 'Try this new material; we know how to produce it on an industrial scale.'" The IFAM is a case apart in the Fraunhofer organization. Sixty percent of its work is financed by military budgets. This is well beyond the average of 13 percent for the Institutes as a whole. At Bremen, interest is centered on amorphous alloys, powder metallurgy, metallic-matrix composites, and nano-crystalline alloys. The IFAM is a world leader in the latter sector. It is a technique that brings metallurgy down to the atomic level. The MBB group installed at Bremen is a potential client for all these materials of the year 2000.

The basic process calls for condensing a gas in an enclosure. Particles of atomic size are obtained, possessing very high surface energy. These characteristics open the way for friable materials at ambient temperatures, with mechanical properties five times superior to those of classic alloys. The IFAM has also just recently scored a major first. The manufacture of a solid bar of amorphous alloy. Starting from solid particles a few microns in diameter, the IFAM fabricated, by explosive compaction, an amorphous bar of nickel-niobium alloy. "We're going to see Siemens, Philips, and IBM and show them these materials. If necessary, I'll offer them to the Japanese builders," concluded Hanz Kunze.

A long-standing bastion of the German machine-tool industry, Aix-la-Chapelle was bound to be host to the IPT [Institute of Production Technologies]. Founded in 1980, the IPT brings together 80 specialists in the techniques of machining, welding and surface treatment. Here again, its work is linked to that of two powerful nearby universities (WZL and RWTH). The members of its "directoire" include some big names in German industry: Fichtel und Sachs, MTV, KHD, Zeiss, Liebherr. Its staffing totals 80 persons including 60 permanent engineers, plus the usual 100 or so student assistants. "They learn above all how to deal with a problem. It takes between 4 and 6 years to earn the degree of doctor engineer," says Clemens Schmitz-Justen, the Institute's chief engineer.

Much of the work done by the IPT is with small-sized enterprises. Its contracts cover the range between DM5,000 and DM250,000. "The first test is often at no charge. We are asked to run a test on a sample." The IPT has chosen a few options well within the tradition of German industry: Precision machining, grinding of optical glass. Delivery by the end of this year is also being awaited on a 22-kW (DM5 million) laser. It will be the most powerful laser installed in the FRG. Ordered from United Technologies, it will be identical to the one now being installed at Arcueil. Preparations

are also under way to install a center specializing in lasers. Under the Eureka program, its work will include research on high-powered, multipurpose lasers.

Other Institutes are doing specialized work. At Freiburg, 70 experts are working on solar energy applications. Work is being done on a continuous process for manufacturing photovoltaic silicon, commencing with a powder. The latter is fused under halogen lamps and recrystallized on a continuous-production basis.

Optoelectronics Replaces Space

This process was used to fabricate prototype cells (100 mm x 100 mm) yielding a conversion efficiency of 12 percent. Next year, an industrial-type machine will become operative. Again, a joint contract between the BMFT and Siemens. At Stuttgart, the IAO [Workplace Technology] takes on ergonomics problems. This is where Marquardt's offset microcomputer-keyboard, now commercialized, was developed.

The IAO has available to it a video studio capable of reconstructing all workplace situations and of studying postures. "In this studio, we reconstruct all the workplace conditions present in industry. We can design equipment around the human being," says Peter Kern, who heads the IAO.

Specialization is also the reason for being of the Institute of Physical Measurements at Freiburg. Originally, this Institute was to devote itself to space technologies. In 1980, it abandoned the space sector and converted to fiber optics and integrated optoelectronic sensors. It worked on optic fiber splicing problems and developed a system accurate within 0.1 micron. It is also working on a whole gamut of chemical detectors (CO_2, CO, NOx, hydrocarbons) for the account of automobile manufacturers, and on the manufacture of Li Nb O crystals.

This all strongly resembles the FRG of the 21st century. "The automobile industry is sure to be Europe's next industrial casualty. We must begin now to think of this and of doing something else," says Hanz Kunze. The heirs of Joseph Von Fraunhofer are managing very well. The Bavarian physicist, inventor of the spectroscope, founded his own firm to capitalize on the research of the last century.

"In your opinion, why are we unable to interest French firms in our research work?" asks Peter Reichel, head of international relations. "We have only the barest of contact." As it approaches its 40th year, the Fraunhofer Group feels it is ready to expand beyond the borders of the FRG. As of now, foreign contracts represent not more than 5 percent of its total, and the European technological programs elicit no enthusiasm on its part. "There's too much bureaucracy. Too much time is wasted on meetings."

Peter Reichel has just returned from a very busy 3-week trip to China. In part, he was on an official West German canvassing mission. "I'm learning Chinese. I already know approximately 1,000 words." Peter Reichel is not really German. He is a Bavarian. "In Bavaria," he says, "we feel closer to the French and the Italians than to the northern Germans. Besides, I've just bought an apartment in Rome for my vacations."

True, indeed. Why do French firms show so little interest in West German applied research?

9399

FRANCE TO START 'EXPERIMENTAL R&D TAX CREDIT' IN FISCAL 1988

36980046 Paris L'USINE NOUVELLE in French 24 Sep 87 p 62

[Article by Marc Chabreuil]

[Text] In 1988, industries will have a choice. Two ways of calculating the research credit tax will be offered them. According to the Ministry of Industry, the new bill to be submitted to Parliament in the very near future, is especially tailored for the so-called traditional PMI [Small- and Medium--Sized Industry]. It is expected to induce the PMI to make an "experimental" start in R&D activity.

This future device, designated the "experimental research and development tax credit," will cover the next 3 tax years. The Government will take into account, each year, the volume of spending on research, up to a maximum of Fr3 million. The sole restriction applies to those rare firms that are already doing research: In their case, the R&D expenditures made in 1987 will be applied against this ceiling each year.

The new bill thus does away with one of the principal criticisms of the tax credit provision instituted in 1983. Based as it was on the annual growth of R&D expenditures, it interested only those industrialists capable of regularly augmenting this activity. For them, the 1983 provision remains in effect, but is to be revised in three respects. First, the present bill provides for elimination of the "reprise"; thus, a firm whose volume of research drops during the year will no longer be required to reimburse the Government for the difference. In the event a firm's R&D activity outside the company results in exceeding the ceiling, the latter will be raised (up to Fr10 million).

Another revision is expected to further the development of new products and processes: The buying, both in France and abroad, of patents or licenses connected with the firm's activities will be counted as an R&D expenditure.

This series of measures will cost the Government a loss of revenue estimated at Fr500 million in 1988.

9238

FRANCE RELEASES 1984-85 FIGURES ON R&D FINANCING BY INDUSTRY

36980046 Paris INDUSTRIES ET TECHNIQUES in French 10 Sep 87 p 33

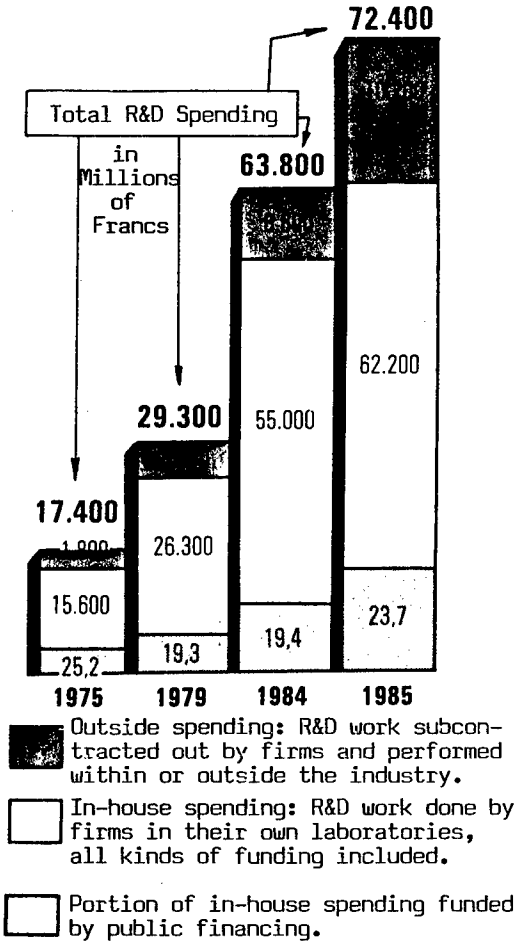
[Article by Gilbert Pointout: "Industrial Research: Fr70 Billion Mark Passed in 1985"]

[Text] The industrial research outlay in 1985 registered a sharp increase: +13 percent. Business enterprises spent over Fr62 billion (Fr62,197 million) of their own funds in 1985, as compared to Fr55 billion in 1984. If Government funding is added to these figures (Fr14,792 million in 1985, up 11.6 percent), the result brings the total to over Fr70 billion (Fr72.4 billion in 1985 versus Fr63.8 billion the preceding year). This increase was the more significant for having been part of a long-term process: Between 1980 and 1985, the volume rose by 30 percent, a level comparable to that of the United States (+36 percent), higher than that of the RFA (+20 percent), but still far below that of Japan (+70 percent).

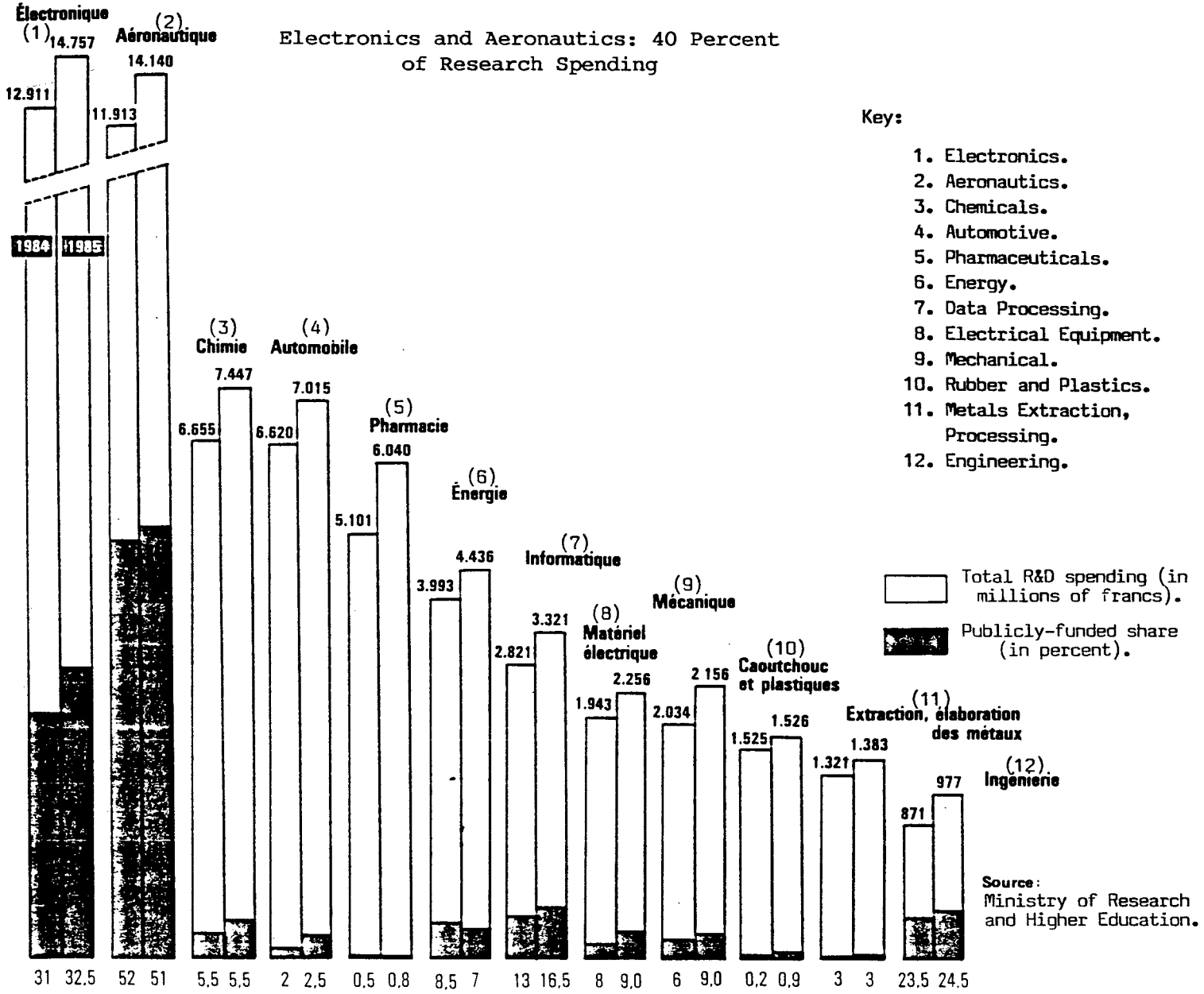
Still, the outlay for industrial research, totaling Fr62.2 billion (representing over 59 percent of the overall outlay for R&D in France), remained unevenly distributed over the industrial fabric. Essentially, the big firms were the ones doing the research: More than 51 percent of in-house expenditures on research emanates from some 60 firms and organizations employing over 5,000 persons (less than 4 percent of the total number of firms and enterprises). By way of contrast, entities employing less than 500 persons (63 percent of the total number) provided only 13 percent of the research outlay.

Unevenness also characterized the breakdown by sectors: Electronics, aeronautics, automotive, chemicals and pharmaceuticals accounted for over two thirds of ongoing research. This was not a new situation, in that, by 1984 these sectors had already become the lead platoon. True, also, certain sectors were receiving a strong push from the Government: 49 percent of public appropriations were going to the aeronautical industries, and 32 percent to electronics, thus constituting for these two sectors respectively, 51 percent and 32 percent of their total R&D budgets.

Industrial Research Spending Increased
by 13 Percent in 1 Year



Electronics and Aeronautics: 40 Percent of Research Spending



Key:

1. Electronics.
2. Aeronautics.
3. Chemicals.
4. Automotive.
5. Pharmaceuticals.
6. Energy.
7. Data Processing.
8. Electrical Equipment.
9. Mechanical.
10. Rubber and Plastics.
11. Metals Extraction, Processing.
12. Engineering.

Total R&D spending (in millions of francs).

Publicly-funded share (in percent).

Source: Ministry of Research and Higher Education.

The number of persons employed in research in 1985 also grew perceptibly: +5.7 percent over 1984 in the case of researchers and engineers, bringing their total to the equivalent of 43,863 full-time persons. All categories combined, R&D employment among enterprises was estimated at 140,000 persons, up only 2 percent.

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EEC RESTRUCTURING RESEARCH FACILITIES TO IMPROVE COMPETITIVENESS

Brussels EEC INFORMATION MEMO in English and French No P-71, Oct 87 pp 1-5

[Article: "A New Look for the Joint Research Centre: Greater Autonomy and New Priorities Geared to Europe's Technological Future"]

[Text] Nine scientific institutes with a European reputation for excellence, increasingly open to outside clients and enjoying, at the same time, a large measure of autonomy to take account of new technological developments internationally and to deal more effectively with the legitimate concern of public opinion about industrial accidents that harm man and his environment: these are the key features of the reshaped Joint Research Centre being proposed by the Commission.

From 1988 onwards the work of the research teams will fall into four main categories:

- implementation of specific multi-annual programmes laid down in the Community's Framework Programme for Research
- providing scientific and technical support for work being done by other Commission departments
- contract research or services for outside partners in the public and private sector
- preparatory research activities to explore new fields of research and to support Europe's technology strategy.

The Specific Programmes

The activities within the specific programmes will be directed along three main avenues:

1) contributing to the completion of a large internal market
2) enhancement of safety and prevention and mitigation of accidents
3) environmental monitoring and protection.

European research will thus be coming to terms with a new reality, namely the creation of a large internal Community market by 1992. In this new context consumer protection is an area which will come in for particular attention, in the form of new standards, quality control and new safety rules. This effort

is also aimed at achieving a significant improvement in the competitiveness of European industry vis-a-vis its non-Community rivals.

If new technologies are to be accepted by the general public, the Commission believes that there is a need to step up the research effort in order to ensure safer products and create a better-protected and renewed environment. The accidents at Chernobyl, Seveso, Bophal and, more recently, Basle present European researchers with major challenges.

Support for Other Commission Departments

The new idea is to make technological research a kind of "leitmotif" running through the various activities of the Commission's departments. This will be a matter of building on work begun over the past few years.

A practical illustration of this type of operation is the remote sensing work on behalf of the Directorate-General for Agriculture aimed, in particular, at compiling a complete European agricultural land register and providing data for the rapid forecasting of potential yields from Europe's farmland.

Other remote sensing activities for non-Community countries will be launched or expanded, particularly in the Sahel region and for the exploitation of fishing zones off the coast of North-West Africa; these projects involve the departments of the Commission responsible both for fisheries and for development policy.

Other research topics due to be developed include energy saving, new forms of energy, protection against atomic radiation, atmospheric pollution control, water quality and industrial waste management.

Services Provided for Third Parties

This is a fundamentally new idea. The Commission wants to see a dramatic increase in the use made of external financing on the basis of contracts with one or more Member States and/or with industrial partners. These activities will grow steadily in importance: by the end of the period 1988-91 they should account for 15 percent of the Joint Research Centre's total activity, and that figure will have doubled by the year 2000.

This represents a diversification of both financial resources and activities that is unprecedented in Europe: no national research centre has ever been this open to the outside.

Preparatory Research

Here, too, the Commission's intention is to innovate. Preparatory research involves exploring new fields and directing research and researchers along fresh avenues. Particular emphasis will be placed on the "scientific vitality" of the institutes by allowing, especially, young scientists of high calibre who are eager to have a degree of freedom in their work to use the institutes' facilities for limited periods.

The Information Technology-Telecommunications-Electronics Triangle

All of these research activities will need to call increasingly on information technologies, telecommunications and electronics. The Commission believes it essential that the expertise of the Joint Research Centre in these fields should be built up so as to ensure that the research work being done is up-to-date and efficient.

In the telecommunications field, in particular, the Commission is proposing that the European Technological Standards Institute, set up under the auspices of the CEPT [European Conference of Postal and Telecommunications Offices], should be based at Ispra.

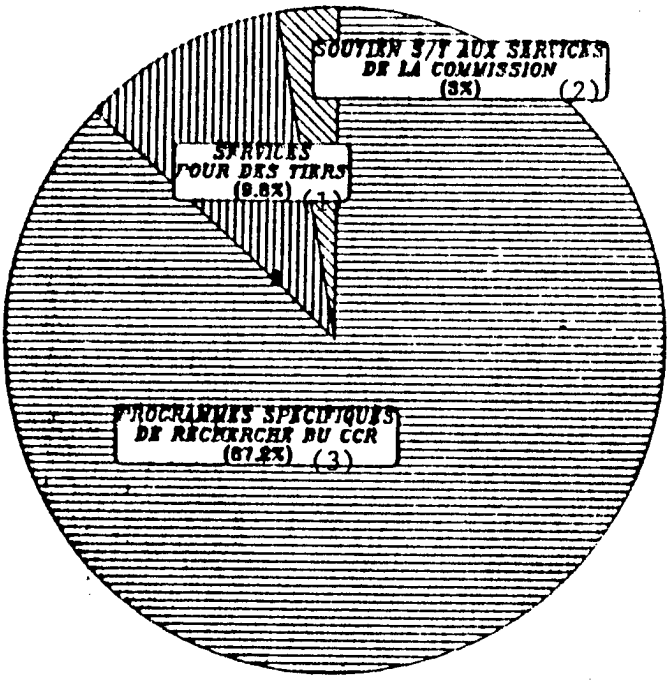
Prospective Technology Studies

Since the launching of European strategic research programmes such as ESPRIT, BRITE and RACE, and the advent of EUREKA, what is important for the Community now is to create a genuine European Technological Area. Prospective studies, assessment and strategic analysis of scientific developments will play a crucial role in achieving that objective.

The Commission is proposing to set up, at Ispra, an Institute for Prospective Technology Studies which will be responsible for carrying out strategic studies at the request of industry, Commission departments or public and private bodies in the Member States.

This initiative is aimed at improving the competitiveness of European industry.

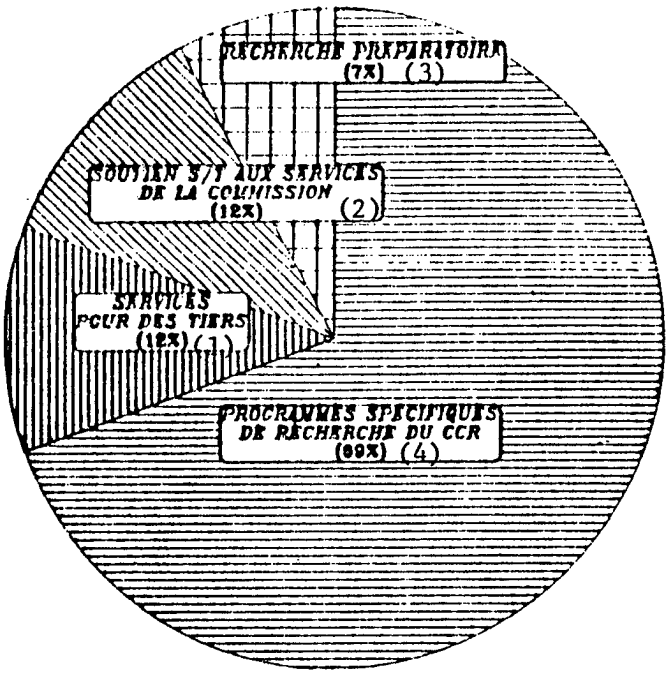
Table 1. 1984-1987 Average



Key:

1. Services to third parties: 9.8 percent
2. S&T support to Commission departments: 3 percent
3. Specific research programs of the Joint Research Center: 87.2 percent

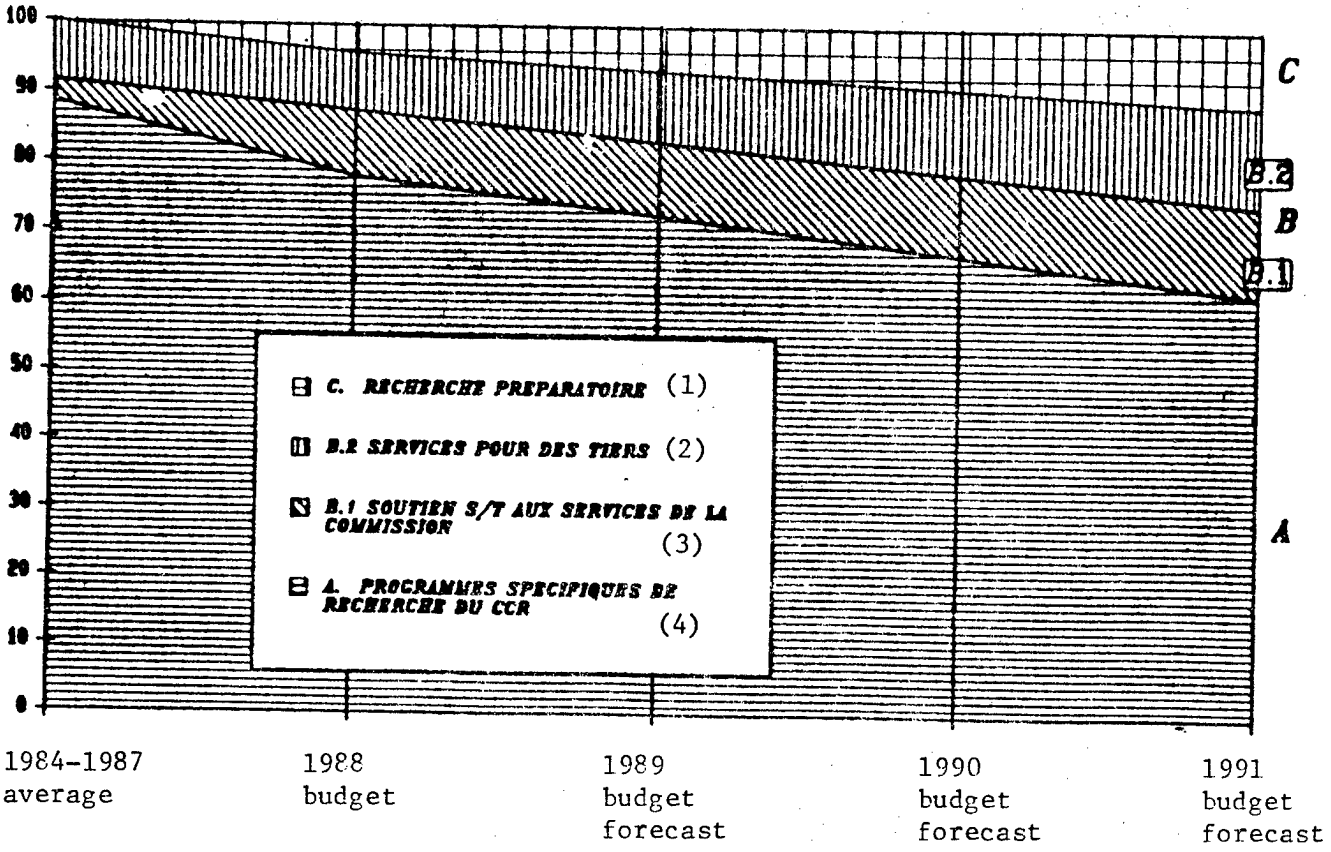
Table 2. 1988-1991 Average



Key:

1. Services to third parties: 12 percent
2. S&T support to Commission departments: 12 percent
3. Preparatory research: 7 percent
4. Specific research programs of the Joint Research Center: 69 percent

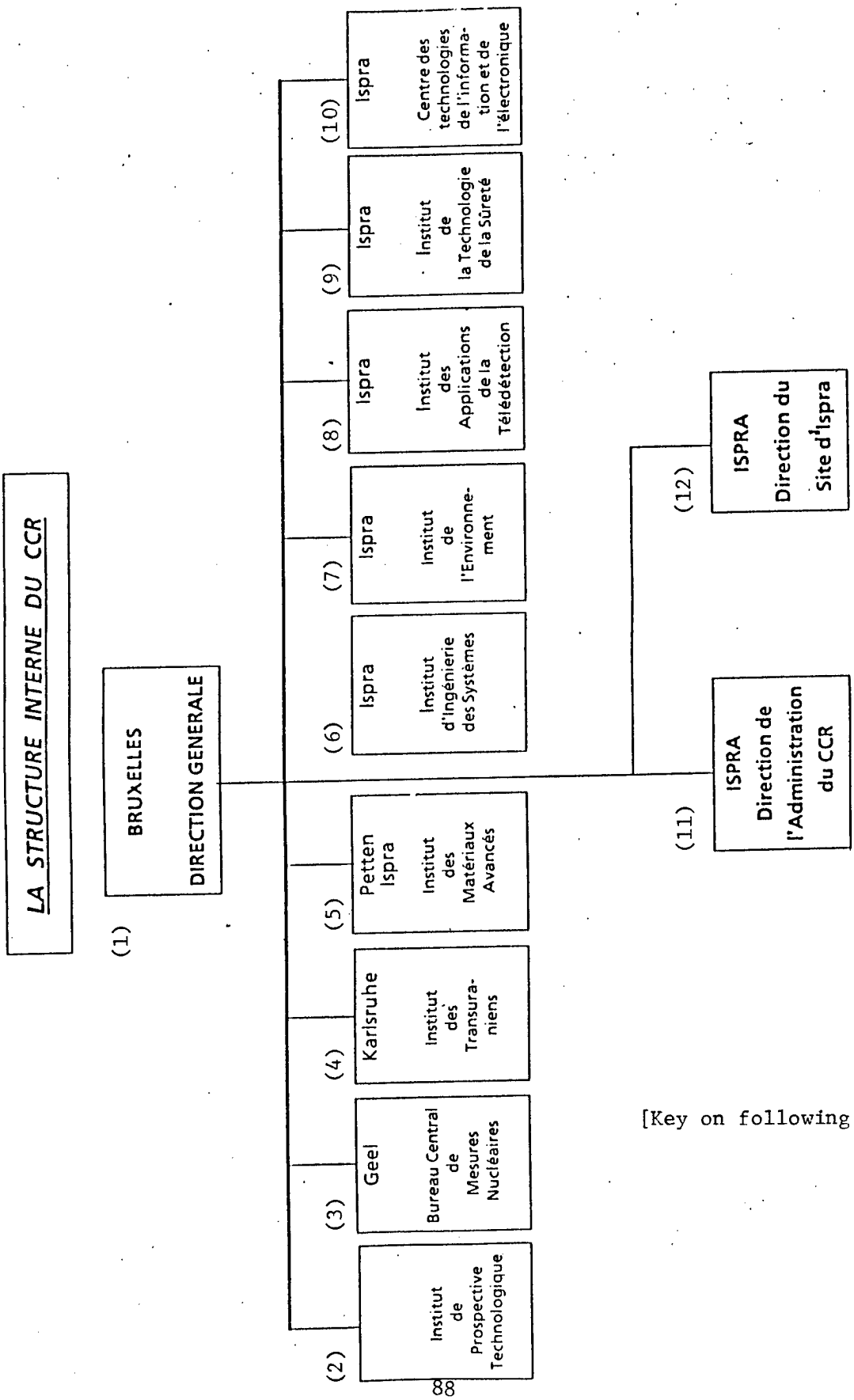
Table 3.



Key:

1. C. Preparatory research
2. B-2 Services to third parties
3. B-1 S&T support to Commission departments
4. A. Specific research programs of the Joint Research Center

Table 4. Internal Structure of the Joint Research Center



[Key on following page]

Key:

1. Brussels: Directorate General
2. Institute for Prospective Technology Studies
3. Geel: Central Bureau for Nuclear Measurements
4. Karlsruhe: Transuranics Institute
5. Petten, Ispra: Institute for Advanced Materials
6. Ispra: Institute for Engineering Systems
7. Ispra: Environmental Institute
8. Ispra: Institute for Remote Sensing Applications
9. Ispra: Institute for Safety Technology
10. Ispra: Center for Electronics and Data Processing Technologies
11. Ispra: Joint Research Center Administration Direction
12. Ispra: Establishment Direction

CSO: 3698A061

RESULTS OF EEC'S BRITE COMPETITION ANNOUNCED

Paris LA LETTRE EUROPEENNE DU PROGRES TECHNIQUE in French 12 Aug 87 pp 3-5

[Article: "BRITE I.2: Perfect...--Initial Results of the Second Call for Proposals"; first two paragraphs are LA LETTRE EUROPEENNE DU PROGRES TECHNIQUE introduction]

[Text] After 10 days of expert assessment by about 100 specialists appointed by the EC Commission and after the meetings of the Management and Coordination Committee on 15 and 27 July, the decisions on the proposals for participation in the second phase of the BRITE program have just been taken. These proposals were submitted prior to 15 May.

LA LETTRE EUROPEENNE presents below the results of the proposals which will be communicated directly to the candidates by the Commission later this month.

The Proposals

The Commission received 471 proposals from about 2,230 participants, or an average of 4.7 partners per project. The average amount of proposed research was at the lower limit of 2 million ECU's. This corresponds to an average research amount which is one-quarter larger than in the projects of the first call for proposals (CFP). Very few projects exceeded 3 million ECU's, since most participants were involved in several projects. The distribution is as follows: 60 percent companies, 23 percent research centers, and 17 percent universities.

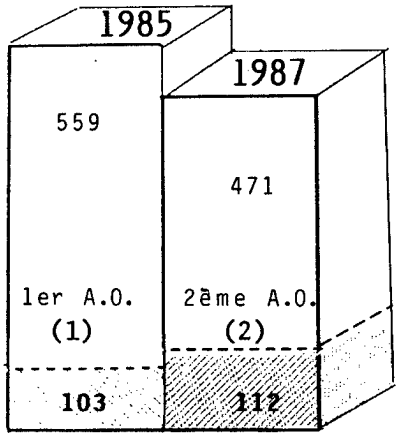
Table 1. Distribution of BRITE Projects

Subjects	Submitted Proposals	Financed Projects	Percent
1. Reliability, wear, and deterioration	111	21	18.9
2. Laser technology	23	4	17.4
3. Assembly methods	26	8	30.8
4. New test methods	65	13	20.0
5. CAD/CAM and mathematical models	88	22	25.0
6. Polymers, composite materials, other new materials, and powder metallurgy	104	24	23.1
7. Science and technology of diaphragms	10	3	30.0
8. Particles catalysis and technology	13	3	23.0
9. New production technologies which are adapted to products made of soft materials	31	14	45.2
Total	471	112	23.8

The Results

Diagram. BRITE I--Evolution of Projects

[Caption] The number of submitted transnational projects is represented by the unshaded area; the number of financed projects is reflected by the shaded area in the diagram



Key:

1. First call for proposals
2. Second call for proposals

As with the first CFP, projects were classified "A," "B," "C," or "D." But the connotation is not the same: Projects currently classified "A," "B," or "C" are considered eligible by the Commission. Projects "A" will be financed from the funds still available from "BRITE I," i.e., 45 million ECU's. In fact it should be noted that 15 million ECU's remain reserved for the continuation of projects selected in the first CFP.

Projects "B" will be financed from phase II of BRITE (1987 budget) out of the 1987-1991 general program with an amount of 60 million ECU's.

It should be noted that a project "B" is not necessarily of lower quality than a project classified "A": In this case, the classification criteria may have

been organizational (for instance, easiness to negotiate the contract, as calculated by the Commission).

Whereas the number of "A" and "B" files amounts to 112 for Europe, 15 proposals have been classified "C": These files, which are often close to "A" and "B," have definite merits in the eyes of the experts. They make up a "waiting list" and will only be financed if the Commission manages to obtain funds (following negotiations with the beneficiaries of files "A" and "B," due to economies, or as a consequence of any withdrawals).

Three hundred forty-four files classified "D" were rejected. This is a rejection rate of 25 percent. The rate was 20 percent in the first CFP.

Three main reasons for the Commission's satisfaction can be noted:
--The participation proposals are more and more in conformity with the specifications. Whereas almost 15 percent of the proposals were not elegible following the first CFP, either because they are not relevant to the subject or because they did not imply cooperative research among various member states of the Community, practically all the proposals of this CFP were within the scope of the program and generally took into account the criteria for eligibility.

--BRITE I.2 attracts a new clientele: About 800 participants were unknown to the BRITE program and to the Community programs in general.

--The rate of participation by small- and medium-sized companies is increasing: Recalling that the Commission considers a company of less than 500 persons a small- or medium-sized company, the percentage increased from 30 to 42 percent. Moreover, over half of the proposals received by the Commission included at least one small- or medium-sized company.

Note: Negotiations with the Commission concerning the files classified "A" should begin in early September and be concluded within a few months. This will be followed by negotiation of the "B" files. The participation of "C" files will only be possible following negotiations on the "A" and "B" files. In any case, all requests for participation in BRITE will receive an official answer from the Commission. From now on national representatives can give some indication to individual requests.

Table 2. Results by Type of Organization Involved

Type of Organization	Total of Proposals	Total of Organizations A+B
Small and medium-sized companies (<500)	559	140
Small and medium-sized companies/industries	42	41
Small and medium-sized companies/total in percent	25	24
TOTAL INDUSTRIES	1,335	343
Percent	59.9	60
UNIVERSITIES	379	88
Percent	17	16.2
RESEARCH CENTERS	516	142
Percent	23.1	24.8
NUMBER OF PARTICIPANTS	2,230	573
Number of participants per project	4.7	5.1
Average cost per project (ECU'S)	1,950,000	1,960,000
Number of proposals	471	112

Table 3. Subdivision by Subject and Type of Organization for the Total of Participations A + B

Subject \ Type	I (including number of small- and medium-sized companies)	U	RC	TOTAL
1	55 (22)	16	34	105
2	20 (3)	2	15	37
3	21 (5)	5	10	36
4	39 (11)	13	19	71
5	78 (46)	15	16	109
6	62 (23)	25	26	113
7	8 (2)	4	2	14
8	8 (5)	3	1	12
9	52 (23)	5	19	76
Total	343 (140)	88	142	573

Key:

I. Industries
U. Universities
RC. Research centers

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CSO: 3698/A007

MATRA GUARDING AGAINST HOSTILE STOCKHOLDERS

Paris L'USINE NOUVELLE in French 17 Sep 87 p 28

[Article by Jean-Pierre Casamayou: "Matra Offers Itself to Europe"; first paragraph is L'USINE NOUVELLE introduction]

[Text] A turning point for Matra and the need to set up a stable group of shareholders: the staff, MMB [not further identified], and the "hand picked" European partners.

Matra's countdown to privatization is accelerating. Before publicly launching 50.1 percent of state-held capital, the company is following a checklist in accordance with previously used procedures. It is almost routine: appointment of a financial auditor, creation of specific stocks, and multiplication of stocks. But there is one notable difference with this company, which is considered to be of strategic importance to the Ministry of Defense: The authorities have decided to attract foreign stockholders.

Twenty percent of the capital involved in any privatization is usually reserved for foreign investors. But since 47 percent of Matra's activities concern weapons and space programs, there is no question of hostile hands controlling part of the capital. Hence the creation of a specific arrangement to protect the company. The state will thus be able to oppose certain purchases and control the makeup of the stockholders.

Matra's return to the private sector represents a much more important turning point than its nationalization. While Matra's capital was before 1981 in the hands of the families of the founders, Sylvain Floirat and Marcel Chassagny, it will now be opened up to a multitude of holders. The rules of the game will change. That is why Matra's chief executive officer, Jean-Luc Lagardere, is striving to form a stable stockholder base, relying on the staff to subscribe to the 10 percent of the capital reserved for it, mobilizing the holding company MMB which represents Fr 750 million, and appealing to "friendly" financial partners.

Logically, those partners can only be manufacturers in the same business as Matra, preferably those who have already signed other agreements: technology agreements as part of EUREKA or ESPRIT, industrial agreements for space activities, weapons, or telecommunications (see diagram).

The Daimler-Benz decision to officially announce its intention to acquire 5 percent of Matra's capital fits within this context. "Transportation, electronics, satellites, we are both in the businesses of the future," assures the Stuttgart-based German company. "This is a good opportunity to strengthen the ties between our companies and Matra." Daimler, which recently acquired MTU [Motors and Turbines United] (aircraft engines), Dornier (aerospace equipment), and AEG (electronics), has resolutely opted for high technology and hopes to conclude more agreements like the scientific satellites accord between its Dornier subsidiary and Matra.

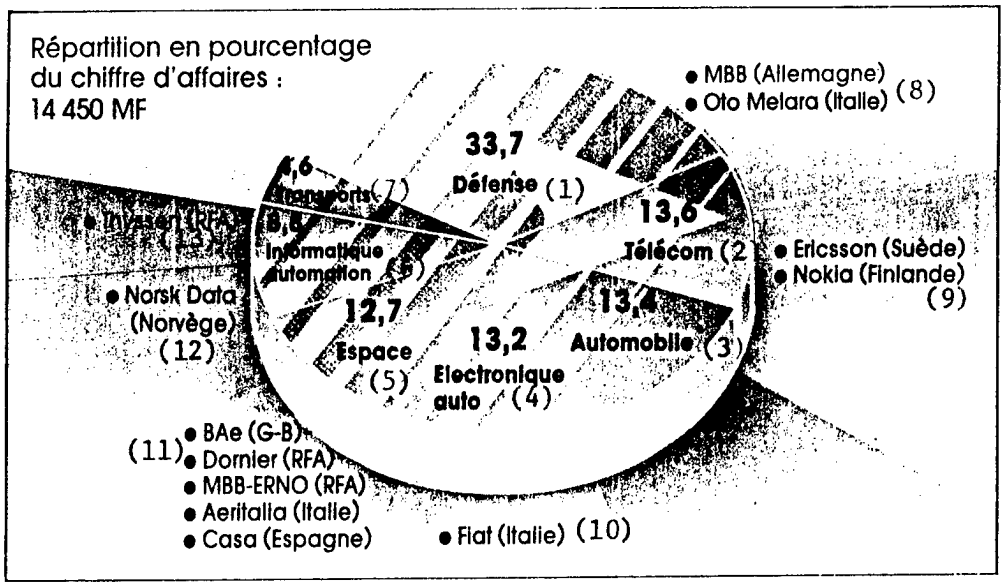
In the same way, the arrival of other partners in the capital stock of the Velizy company could strengthen already existing industrial ties. The Swedish Ericsson (telephone), the Italian companies Fiat and Aeritalia, and British Aerospace are said to be interested. It is a delicate choice, because for Matra there are friends and "friends." While, for example, BAe [British Aerospace Corporation] is Matra's ally in the field of satellites, it remains a formidable competitor in the field of airborne weapons. A financial alliance would not seem a very good match if cooperation is not extended to these fields.

Other companies, on the contrary, would make natural allies. In the field of anti-ship missiles there has been long-standing cooperation between Matra and Oto Melara, a company of the state group EFIM [Finance and Holding Company of Manufacturing Industry] which has just joined forces with Fiat and SNIA PBD [National Company for the Aerospace Industry] within an "Italmissile" consortium. Ericsson is Matra's privileged partner in telecommunications.

This foreign interest is closely watched by the authorities, by Edouard Balladur, patron of privatization, and by Andre Giraud, minister of defense, who is not opposed to the entry of European manufacturers into Matra. On the contrary, the minister of defense thinks it is a good strategy to achieve a single arms market. "By opening our doors to Europe, the synergy between the parties will be better than if we limit ourselves to France," is said at the ministry on rue Saint-Dominique. "What is more, it will raise the bidding."

There seems to be unanimous consensus in favor of foreign manufacturers entering Matra, even though this view is not openly expressed. It proves that industrial nationalism is being overcome by European "internationalism" which has been redrawing the map of corporate capital since the beginning of the year.

Table. Matra's Industrial Partners
Breakdown of revenues in percentages: Fr 14,450 million



Key:

1. Defense
2. Telecommunications
3. Automobiles
4. Automobile Electronics
5. Space
6. Data Processing/Automation
7. Transportation
8. MBB (FRG)
   Oto Melara (Italy)
9. Ericsson (Sweden)
   Nokia (Finland)
10. Fiat (Italy)
11. BAe (UK)
    Dornier (FRG)
    MBB-ERNO (FRG)
    Aeritalia (Italy)
    Casa (Spain)
12. Norsk Data (Norway)
13. Thyssen (FRG)

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CSO: 3698/A022

PHASE TWO OF ESPRIT DISCUSSED

Paris ZERO UN INFORMATIQUE in French 5 Oct 87 p 3

[Article by Philippe Moins: "A Second Breath for ESPRIT"; first paragraph is ZERO UN INFORMATIQUE introduction]

[Text] The second phase of the ESPRIT program (1987-1991) will benefit from a doubling of funds: 3.2 billion ECU's instead of 1.5 billion for ESPRIT 1. On the program: more integration toward industry and greater interest in supercomputers.

Celebration of European technology in Brussels. The EEC research ministers have finally adopted the Community's research framework program for 1987-1991. It will have taken the 12 EEC countries more than 6 months to arrive at a budget compromise; the start of specific programs has been delayed accordingly. A sigh of relief was on the lips of all the participants at the fourth ESPRIT conference: Once the overall budget is voted, it will only be a matter of days before the second phase of ESPRIT is launched. It should be ratified during a meeting at the end of November, followed immediately by the issue of competitive bids.

Everything will then move very quickly: the bid deadline in February 1988 and the start of the ESPRIT 2 projects by mid-1988. In 18 months we will have to make up for the delays accumulated over 6 months," participants were heard commenting in the corridors of the Palais des Congres in Brussels.

The second phase of the ESPRIT program, which will cover the 1988-1991 period, will have a budget double that of the first phase: 3.2 billion ECU's (1 ECU is equivalent to about Fr 6) instead of 1.5 billion ECU's for ESPRIT 1.

This investment represents more than 20,000 man-years of work: Once ESPRIT 2 is fully launched, it will employ 5,000 to 6,000 people annually, compared with 2,000 during the peak periods of ESPRIT 1.

However, even when multiplied by two, ESPRIT funding remains insufficient. Compared to agriculture, which absorbs 60 percent of the EEC budget, data processing is the poor cousin with barely 1 percent of the EEC budget. Corporations, scientists, members of the Commission, all agree in deploring the "limited" and even "inadequate" funding allocated to ESPRIT.

The problem can be summarized in one statistic: The funds allocated by the member states to EEC research represent only 1 percent of all the national research budgets combined.

"ESPRIT Should Put an End to European Decline"

Will ESPRIT have only a symbolic scope in view of this inadequate funding?

Participants in the conference held in Brussels last week tried to prove the opposite. First by organizing an exhibition of about 50 workshops, a kind of showroom of work accomplished within the ESPRIT framework. Then by evaluating the state of progress of ESPRIT 1.

A few tangible developments can already be added to the records of this program, such as PCTE [portable common tool environment] software engineering workshop environment (about to become a European standard) or Supernode, a parallel-architecture system by Inmos that is based on "transputers."

In all, 25 out of 227 projects started since 1984 have reached maturity. This still relatively low proportion is explained by a rather long gestation period: Each project requires an average of 5 years of development.

According to Jean-Marie Cadiou, section chief of the ESPRIT program at the Commission in Brussels, 106 projects, or one of two, show significant results. Twenty-eight contributed to standardization, while 71 others affected products or services.

Jacques Stern, chairman of the Bull group, placed the development of the ESPRIT program into a larger perspective: "ESPRIT should put an end to European decline in accord with three objectives: assure that European industry rediscovers its technological level, teach it to cooperate, and encourage standardization for a genuine European market. Today, nobody can question ESPRIT's unexpected success. European industry is holding up its head."

As an example, the market share of European data processing companies has increased in Europe from 34.3 percent in 1981 to 36.4 percent in 1985 and then to 42.5 percent in 1986. "ESPRIT 1 boosted the number of projects. How many will result in products? ESPRIT 2 must have other ambitions, particularly concentration on strategic projects."

ESPRIT 2 will be more pragmatic and comprise deliberately application-oriented projects, although this may cause interference with EUREKA. Whereas the scope of both programs has thus far been clearly defined (precompetitive research at ESPRIT, development of marketable products at EUREKA), the boundaries may be redrawn in future years. ESPRIT's extension in the direction of EUREKA is, in any case, "a working hypothesis which will be studied in greater detail." In Brussels Jacques Stern was the most enthusiastic advocate of this new focus of ESPRIT 2. "In ESPRIT 2 industry can no longer be separated from research." The first manifestation of this approach was the introduction of the term "TIP" (Technology Integration Project) to designate projects of a new kind.

The TIP's will result in the integration of fragmented research into a single system. An assembly of bricks, in a way, closer to a marketable product than to pure research.

To give an example: Whereas ESPRIT 1 concentrated on the actual technology of parallel architectures, ESPRIT 2 will initiate at least two TIP's on parallel architectures which are extensions of research conducted during the first phase.

Weightier projects are also to be expected: ESPRIT 1 included jobs of 45 man-years (type B) or of 100 or even 300 man-years (type A); ESPRIT 2 will sometimes take on projects of as many as 600 man-years.

The start of this second phase will also allow the EEC to open its doors to new partners: The EFTA [European Free Trade Association] countries (Austria, Sweden, Switzerland, Norway, Finland) can now participate in the ESPRIT program.

The contents of phase 2 remain to be defined. However, some trends can already be detected: There will be more CIM projects (only 15 percent of ESPRIT 1 projects involved computer-integrated manufacturing), more integration with industry (with the TIP's), and a new priority will be assigned to supercomputers.

This last preoccupation was echoed in the words of Jacques Stern: "It is unacceptable that Europe would not be able to manufacture scientific supercomputers. It is also unacceptable that Europe would not have large storage systems."

"Finally, it is unacceptable to have to depend on two American suppliers in the field of microprocessors." The major guidelines of ESPRIT 2 have been drawn.

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CSO: 3698A042

NETHERLANDS GOVERNMENT CALLING FOR INCREASED S&T BUDGET

Amsterdam COMPUTERWORLD in Dutch 20 Oct 87 p 1

[Text] The Hague--Industry will see its budget for research in information technology cut by 9.6 million guilders, whereas the overall budget for PBTS [Company-Oriented Technology Stimulation Program] is being increased by as much as 43.4 million guilders. This information was the object of a letter written by Mr De Korte, the Netherlands minister of economic affairs, to the Netherlands House of Representatives.

The Netherlands Government launched the PBTS program in March of this year. Its aim is to encourage research in four privileged sectors of the Netherlands economy: information technology, materials technology, medical technology, and biotechnology.

According to De Korte, Netherlands companies showed great enthusiasm for this program. In several research areas the demand for subsidies exceeded the government's resources. Only for information technology funds was the demand limited. Apparently in that particular sector people do not know how to get necessary funding.

It seems hard to believe that the information sector does not require any research money. Because of the favorable response in the other three sectors, Minister De Korte increased the overall PBTS budget to 124 million guilders, following the advice of the Social and Economic Council and the Dekker Commission.

Commitments

For biotechnology research, 27 million guilders are available, for materials research, 55 million, and for medical technology, 10.5 million. Information technology has to settle for 31.5 million guilders.

All in all companies can now be sure that about half the subsidies applied for will actually be granted. According to Minister De Korte, if the Netherlands House of Representatives approves the budget increases, final commitments will be made by 22 October at the latest.

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CSO: 3698A055

Use of CAD/CAM at GDR Robotron Factory in Soemmerda

23020002a Berlin FEINGERAETETECHNIK in German No 9, 1987 pp 394-399

[Article by Dr R. Hesse, Mr E. Hase and Mr. D. Jordan of VEB Robotron "Ernst Thaelmann" Office Machines Plant, Soemmerda: "CAD/CAM Solution to Preparation and Control of Production at the VEB Robotron 'Ernst Thaelmann' Office Machines Plant, Soemmerda"]

[Excerpts] The key technologies have special significance in the national economy of the GDR. The VEB Robotron "Ernst Thaelmann" Office Machines Plant in Soemmerda [VEB BWS] has the task of producing and making available CAD/CAM technology for these industries. This involves the following products:

- PC 1715 personal computers and its further development
- Printers
- Stepping motors.

Because of the demand for these products in developing the intensification of the overall national economy, above-average rates of increase in production are necessary for 1987 compared to 1986:

- Personal computers by 118 percent
- Printers by 125 percent
- Stepping motors by 147 percent.

In order to achieve this increase in output, a complex CAD/CAM application system is being developed and linked up in stages. This is taking place in step with the modernization of production.

To this end, work has been carried on since 1985 by an interdisciplinary production team from the areas of research and development, technology and rationalization, production, and organization and data processing.

2. CAM Solution for Control and Supervision of Stepping Motor Production

2.1. Basic Process

The basic process of stepping motor production is divided into three production areas with 16 automation aggregates linked to one another through manual means of transport (pallet cars, etc.). Each aggregate comprises two to four automated machines, some of which can be reequipped for different purposes and some of which are single-purpose machines.

The production areas are divided into preproduction, preassembly and final assembly. The following automation aggregates are subject to this subdivision:

Area of preproduction (production of front and rear bearing cap, end frame and rotor)

- Mechanical treatment of the bearing caps, end frames and rotors
- Insertion of ball bearings

Area of stator production (complete production of stators, Figure 2)

- Coil production (tinned and tested coils)
- Stator production (stamping and welding of the stator unit)
- Completion of the stator (insertion of the coils in the stator unit, completion, testing)

Area of final assembly (production of stepping motors)

- Stator assembly
- Motor assembly (Figure 3)
- Motor testing.

The following components of the basic system are interfaces within the area of stepping motor production itself, as well as between this area and the central material economy, or the central preproduction process and marketing area of the office machines plant:

- Basic unit inventory
- Assembly preparation inventory
- Finished goods inventory
- Central parts cleaning plant

Figure 4 depicts the correlation between the basic system components.

2.2. Description of the FLIS 1.1 CAM Solution as an Important Medium of the Information Process

The FLIS 1 CAM solution for computer-supported production organization of stepping motor production at VEB BWS is a relatively uncomplicated and inexpensive solution based on eight-bit computer technology that reflects the production conditions typical today in small to medium-sized production areas. A further precondition for the application of this expansion stage is a product structure that is not too complicated (around 500 parts and structural components).

FLIS 1 is a closed unit; however, it can be coupled with solutions concerned with more complex general business planning and accounting or to technology management. The FLIS 1.1 overall project currently in use consists of the components named in Table 1:

Figure 5 shows the job structure of this multi-computer solution. The technical structure is presented in Section 3.

Data Base Solution

The ESER data base solution is based on the DBS 25 data base system from the CSSR. It exists as an indexed system of sub-data bases containing subject data and work place data. Main access to the data is possible through the product's commercial ID number or through the cost center number. In the data base for subject data, data on demand, inventory, work plan, monthly plan, orders, etc. are linked in memory, while the work place data base contains data on manpower, machines and their availability, similarly stored. The data base is serviced by a series of stack projects on the ESER system with a tested updating service, as well as in the user domain. Using a computer-supported information catalog, the user can link up with the ESER computer, and he works with the menu-controlled information system (IS) that contains the data base.

The terminals of the ESER computer, which in the area of stepping motor production are generally PC 1715s, are connected using emulation software for supporting the BSC I/BSC III synchronous listing by VEB Kombinat Chemieanlagenbau Leipzig/Grimma.

In addition to interactive functions, particular use is made of file transfer between the ESER system and PC 1715s.

The data base structure consists of

a) Subject data (e.g., inventory, work place structure, annual plan customer demand)

b) Work place data (cost center, manpower (employment possibilities), workplace structure (machine))

Management and Maintenance of Technological Data

The technological data of the stepping motors are decentrally managed and maintained at the PRO 15 S technology work place. In conjunction with the above-mentioned data base, all technologies currently needed are fully managed in the ESER system. They are available both to the non-central order structure and to the IS.

There is a basic diskette at the PRO 15 S work place for each technologist. Each day, changes can be exchanged to the data base in the form of complete technology. The reject rate is consequently minimal. Production can use up to 10 technologies (variations) of a type of motor.

The data structures are seen in Figure 5:

a) Basic work plan chart

The structure of this volume of data corresponds to the standard according to the structure of the FB 1 of the Central Office for Primary Documentation (ZPD) of the GDR.

b) T

t = {(overriding item (secondary item, frequency/material use norm, unit of quantity)}

Management and Maintenance of Planning Data

In keeping with Figure 5, centrally organized management of planning data dealing with customer-specific monthly demand for stepping motors was developed with the ESER system. The following tasks are carried out in the part concerned with planning the FLIS 1.1. system:

-- Management of the commission plan by the central structural unit "production control"

-- Comparison of planned and actual values for individual parts and structural components

-- Forecast of demand for individual parts and structural components.

All tasks are run using data remote processing.

It is significant that planning data is transmitted/received on-line to the chief clerk work place in the FLIS-1 system, and that the number of finished units is returned to the data base via the same work place.

The data structure for this communication consists of

a) Final product demand (E)

final product demand = {ID number (month, demand)}

b) Structural components/parts demand
demand = {ID number (month, demand)}

c) Supplemental demand (P)
supplemental demand = {ID number (month, demand)}

d) Actual results (IST)
movements = {ID number (commission (day, IST))}.

The commission plan is registered on the 20th of the previous month. Changes in the planning month are made by the end of the month through the "control" structural unit in agreement with the sales area and the stepping motor production area. The data structure of the planning data presented by the sales area is as follows:

Customer-related final product demand = {commission (ID number (month (day, demand))}.

At the end of the month, the transmission of the plan demand leads to a summarization of customer-related final product demand into final product demand (E). Based on the final product demand (E), an appraisal of demand for structural components, parts and material is performed on the ESER system using the method of piece list resolution (B). In the case of damaged goods, resolution for structural component and material demand is also possible using the FLIS system. Supplemental demand (P) is always determined using the FLIS-1 system from demonstrable, technologically based additional demand. A transfer to the ESER computer takes place prior to the above-mentioned piece list resolution. The determined demand is stored in the data base and an archive copy is kept there for 3 months. Using the daily actual reports from the FLIS system to the ESER system (IST), a day-to-day comparison of planned and actual values is possible that can be called up from the IS.

Progress Control

The FLIS system subtask "progress control" is an essential component of any control solution. It begins with the release of a lot for production and ends with the final lot notice and billing. The essential information of progress control is:

fd = {order number/lot number, ID number (preparation check), disposable stock on hand, shortage), (inventory output, inventory input), (cost center status), (operational data terminal messages: beginning of work period (M1), beginning of order (M3), end of work period (M2), end of order (M4), machine number, process,
manpower infomation,
actual volume [good/waste] (M5, M6))}

The fd information structure shows the complexity of progress control.

There is an important interface between the inventory and the cost center after confirmation of the order as well as at the end of the order. Inventory quantities issued and received are posted with the K 8913 inventory terminal. The so-called production control sites constitute other important interfaces. Each of these functions as a production-internal testing site for product quality and quantity in each of the following production sections: coiling section, stator stamping section/welding section, stator completion, rotor production and final assembly. The control findings are entered into separately arranged operational data terminals [BDTs], and copied so that any losses of data and processing errors can be evaluated. The FLIS organization makes it possible for any producing cost center to pass along its finished structural components directly to the receiving cost center according to technology after input of the realization message using the BDTs in the process after testing at the F control site, including BDT input. Delivery "via inventory" is similarly projectable and usable. Based on the inventory and circulating stock system generated in this way, the organization of orders is possible:

a) without the creation of parts shortages through an operative reduction of plan size to the level of existing stock,

b) with the creation of parts shortages at send-out points and subsequent send-off using a parts shortage file.

A lot exists during the production process at precisely that point at which the processer--meaning a machine operator or F controller--has started the M3 beginning of order BDT program. Using the object number, order number/lot number information chain, the order placement file is checked to see whether the lot was released, and in this way the machine file is brought up to date. After this, input on automatic item counting or manual parts counting is allowed. The information "actual quantity good" and "waste quantity" are managed in real-time mode for every generated work place. M1 = beginning of work period regulates each of these quantities until the value is 0, while M2 = end of work period results in the final updating of these fields in the process or machine file.

The FLIS 1 system presented here works in three-shift operation. This means on the one hand that each shift under the responsibility of a shift manager takes over the system in a very disciplined way at the beginning of the shift, continually inputs actual results and at the end of the shift performs the prescribed sign-off algorithm in conjuction with the last status input on plan fulfillment of the respective shift. On the other hand, the performance of the previous three shifts is to be sent to the ESER computer at the end of the night shift. This transmittal is possible from each of the PC 1715s linked to the ESER computer using file transfer by way of data remote processing, or by diskette exchange (damaged goods variation). The state management of stepping motor production and of central production management, as well as members of the enterprise management of BWS can, on the basis of computer technology, consult with the enterprise director every day as

of 7:00 am concerning the range of stepping motor products. Areas of discussion can include the status of plan fulfillment, further preparations of material production and the operative working situation (manpower and machine availability).

Figure 6 shows the essential status information for planning, assessment, order placement and progress control.

(The bibliography will be published in Part 2 of the article, in the next issue).

Table 1. Components of the Currently Used FLIS 1.1 CAM Project

-- Input and processing of current monthly demand (ESER I to ESER II and PC 1715 to ESER, off line)

-- Reception of temporarily confirmed customer-related specification and commission data (date remote processing ESER to PC 1715)

-- Non-central management and maintenance of technologies, transmission to the ESER computer for the technology base file and the central technical information system (data remote processing PC 1715 to ESER)

-- Reception of structural components and parts demand resolved using piece list and technology (data remote processing ESER to PC 1715) for monthly order organization and send-off via FLIS 1

-- Placement of order volume dependent on material supply, operative manpower and machine availability and current, final demand situation, lot organization

-- Real-time inventory preparation of orders, postings

-- Non-central, operative recording of the presence of workers and maintenance specialists in the shifts

-- Real-time recording of order processing and down periods using process terminal technology (BDT K 8901) that are linked to the tool machines via signal lines

-- Parallel real-time recording of order processing at so-called production control sites using manual input into an operational data terminal (BDT)

-- Progress control and comparison of planned and actual values using FLIS 1715 (computer link PC 1715/system drive unit K 8524 on V.24 base in master-slave mode)

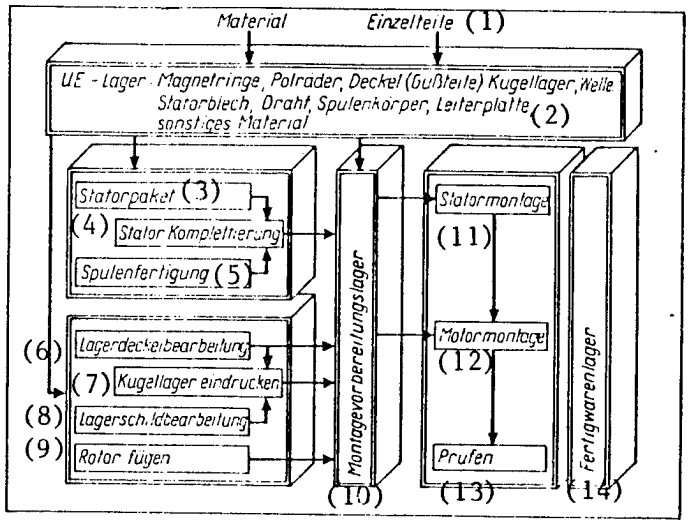
-- Transmission of pre-evaluated actual data on range of products and on system conditions to the ESER computer as basis for operational information system

-- Processing of overall situation evaluations, fulfillment status messages with respect to quality, quantity on the ESER computer and availability in the operational information system for all permitted management levels.

-- Utilization of services and findings of the FLIS 1715, using ESER technology by way of PC 1715, linked on line and operated by data remote processing

-- Management of the various data and in particular the data interfaces between FLIS 1 and the central data base, and vice versa. Essentially, demand and actual fulfillment messages are exchanged using file transfer over data remote transfer lines under BSC control.

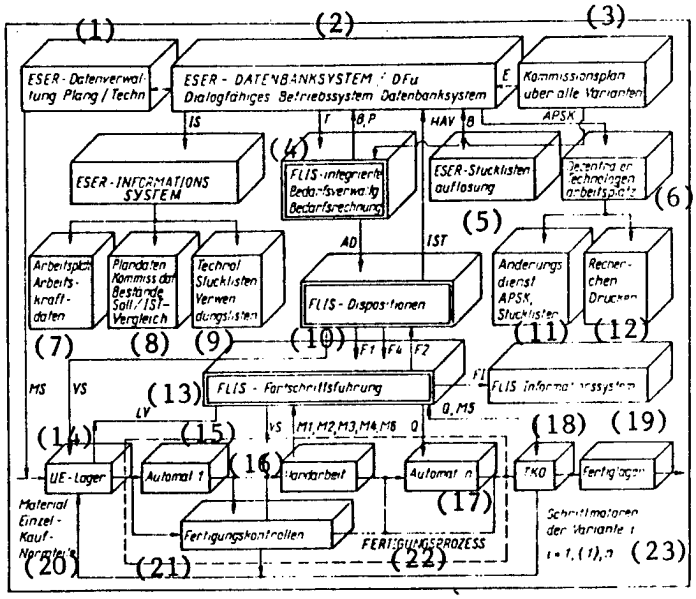
Figure 4. Correlation Between the Basic Compenents



Key:

(1) Individual parts
(2) Basic unit inventory: magnet rings, magnet wheels, caps (cast parts) to ball bearings, shaft, stator plate, wire, coil formers, printed circuit board, other material
(3) Stator unit
(4) Stator completion
(5) Coil production
(6) Bearing cap piece processing
(7) Ball bearing inserted
(8) End piece processing
(9) Rotor assembly work
(10) Assembly preparation inventory
(11) Stator assembly
(12) Motor assembly
(13) Testing
(14) Finished goods inventory

Figure 5. Structure of the FLIS 1.1 Information System for a Multi-Computer Solution, Linked up Across Four Levels (see 2.2.1., Data Bank Solution, for explanation)



Key:

(1) ESER data management, planning/technology
(2) ESER data base system/data remote transfer, interactive operating system, data base system
(3) Commission plan on all variations
(4) FLIS integrated demand management, demand calculation
(5) ESER piece list resolution
(6) Non-central technologist work place
(7) Work place, manpower data
(8) Plan data, commission data, stock on hand, comparison of planned and actual values
(9) Technology pice lists, utilization lists
(10) FLIS order placements
(11) APSK modification service, piece lists
(12) Computers, printers
(13) FLIS progress control
(14) Basic unit inventory
(15) Machine 1
(16) Manual labor
(17) Machine n
(18) Technical control organization
(19) Finished goods inventory
(20) Material, single, purchased, norm parts
(21) Production controls
(22) Production process
(23) Stepping motors of variation t

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POLAND USES LIDAR TO CONDUCT LOWER ATMOSPHERE SOUNDINGS

Warsaw PRZEGLAD GEOFIZYCZNY in Polish No 3, 1987 pp 341-345

[Article by Andrzej Bielak and Wieslaw Kaszowski of The Krakow Institute for Meteorology and Water Resources Management: "Preliminary Results of the Vertical Soundings of the Lower Atmosphere Using Lidar"]

[Text] Lidar, which was built at the IMGW [Institute for Meteorology and Water Resources Management] Bureau of Remote Sensing of the Atmosphere, is a device designed to examine aerosol layers. It can be used for vertical soundings and, with the use of another stand, to investigate the diffusion of smoke plumes. Descriptions of such experiments can be found in papers by Bielak and Kaszowski (1985, 1986); and by Bielak and others (1985).

This article presents the preliminary results of sequential vertical soundings conducted between 13.45 LT of 1 July 1985 and 15.00 LT of 12 July 1985. The soundings were made at various frequencies depending on existing weather conditions. In the situation where a distinct Lidar echo from the reflection layers was not observed on the oscilloscope screen, observations were made on average every 15 minutes. When strong echoes were obtained, as indicated by the existence of highly reflected laser beams from the layers, observations were made every 2 minutes. The Lidar pulses were also photographed for further processing. The Lidar data obtained during the experiment are very extensive, encompassing 1,920 soundings and about (according to intial estimates) 57,000 points (centers of reflection) that were obtained from the grams. Processing each gram consisted of establishing the location of the characteristic points (time) and signal amplitudes. This data was then transferred manually, via a computer, onto magnetic tape. Maintaining the data in such a form makes it possible to use the data at a later date in conjunction with different computer programs.

A representative sample of the results is shown in Figure 1 in the form of diagrams, in which the heights of the centers of reflection are shown as a function of time. Such a presentation of the data permits observation of the equilibrium of the atmosphere, especially the detection of retardation layers. On the basis of these diagrams, it can be stated that during the experiment the reflections from the designated heights were not strong enough to suggest the occurrence of raised retardation layers. Thee upper limit at which reflections occured can be assumed to be the limit at which convection

movements occurred. In comparing the data based on the Lidar soundings with the Sodar data (see Walczynski, 1985), it can be assumed that the depths of the mixing layers detected via Lidar are at least two times greater than the heights of the convection cells recorded by Sodar when convection exists. For example, the Sodar data recorded 2 July between 2 pm and 3 pm show that the convection limit was about 250 m, whereas during that same period (as shown in Figure 1b), the Lidar recorded the upper convection limit as 500 m. A similar situation occurred 3 July between 1 pm and 4 pm when the respective heights were about 300 and 600 m. In addition, Lidar indicated the existence (especially at night) of reflection layers above the layer echoes recorded on the Sodar grams. Due to insufficient Lidar data processing results, an unequivocal interpretation of these differences is difficult.

The Lidar used in the experiment required constant manual service as well as boring data processing (preliminary manual processing prior to magnetic recording). After obtaining much information from vertical soundings, which indicates important information about the lower atmosphere can be obtained by this method, the construction of a Lidar station has been initiated that will be used exclusively for vertical soundings. The automatization of the entire station was emphasized, including data recording and processing. To this end an oscilloscope was purchased that can operate in conjunction with a computer via an interface, which will eliminate manual data processing. It is projected that the computer will also be used to control other essential station equipment. The concept of routing Lidar signals that are transmitted and disseminated back via a reflector located outside the station has been verified. Such a solution will permit to a certain extent measurements that do not depend on the weather. With the equipment used in the above described experiment, it was often necessary to discontinue measurements when it rained because the entire Lidar unit had to be located beyond its permanent location.

The most important advantage ensuing from the use of Lidar to conduct vertical soundings is that it enables information to be obtained about the location of horizontal dust layers and thus the ability to designate the occurrence of inversion layers, convections and depths of mixing when convections take place. When the structure of reflection is known, the concentration of particles in a reflection layer can be determined (Bielak, Kaszowski, 1985). In addition, vertical Lidar soundings can be an independent source of information about the state of the lower atmosphere and represent a supplementary source of information for other parallel methods (Sodar, baloon soundings).

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CSO: 2602/6

BRAZIL'S EMBRAMIL TO ACQUIRE ROCKET TECHNOLOGY

Sao Paulo GAZETA MERCANTIL in English 30 Nov 87 p 8

[Text]

Embramil Consultoria e Comércio S.A. has signed a contract with Oerlikon-Buhrle Ltd. of Switzerland, one of the world's biggest arms manufacturer, to absorb technology for production of five kinds of 81mm caliber missiles. The contract, worth $4.5 million, calls for payment over the next three years.

The company, which plans to build the plant in Rio de Janeiro, expects to begin production as early as next year to start selling its missiles in the last quarter of the year, says Altamir Seabra of Embramil. "We initially intend to only export our products to Latin America, the Middle East and Africa, where we plan to compete with Russian and Chinese manufacturers of similar missiles," Seabra says.

Embramil doesn't discard the possibility that its missiles surface-to-surface and air-to-surface may eventually be used by the Brazilian Air Force and Army.

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BRAZILIAN COMPUTER SECTOR LEADERS ADVOCATE RESTRUCTURING

Sao Paulo DADOS E IDEIAS in Portuguese Oct 87 pp 20-22

[Article by Heloisa Magalhaes with the collaboration of Claudia Bensimon and Rodolfo Lucena: "Race Against Time"]

[Text] Data processing enterprises are going off in search of ways that would enable them to grow stronger and to obtain capital in a bitter race against time since the crisis demonstrated the frailty of the model and the urgent need for corrections.

Edson Fregni, president of Scopus Tecnologia and former president of Abicomp, expects that the process of mergers or takeovers among domestic data processing enterprises will start by the end of the year. In his opinion, this is a way out for the sector which is today facing difficulties ranging from the trouble the enterprises are having in getting capital all the way to the "predatory and suicidal fight for markets" where many industrial establishments that make the same products exist together with manpower and money shortages and moreover are exposed to the "impact of unrestrained smuggling." Fregni says that "pulverization has led to frailty, reminding us that we were lacking definitions, ways of getting things done, an industrial policy, and investments in segments that are fundamental to the success of national data processing policy, such microelectronics and software.

Claudio Mammanna, the representative of the manufacturers and president of Abicomp, admits that the organization is seeking a closer approach between enterprises, not only among themselves but also in the search for interaction of private capitalist partners. Antonio Carlos do Rego Gil, of SID Informatica, the man in charge of the nation's biggest private data processing establishment, is quite emphatic: "Merger is the way out. We need strong, capitalized groups, with technological competence, a certain production scale, managed according to sound practices."

Mergers and incorporations indeed are only one of the ways by which the nation's data processing industry can continue to try to grow stronger. The most important in the discussion now being conducted regarding the sector's future is directly tied to the fact that the industry is capital-intensive, with products that bring ever shorter periods of obsolescence. The crux of the matter is how the national model of data processing can balance the

necessary capitalization with the dynamic nature of technology, winning an output scale at levels that guarantee competitive prices and the kind of competence that will lead to autonomy in segments compatible with the Brazilian situation such as it really is.

The frailty of the data processing model and the enterprises themselves emerged quite clearly in the light of the financial trouble which the various establishments encountered during the first crisis they faced. Critics were not worried about the future; the necessary reinvestment of profits generated during consecutive years of growth was between 20 and 30 percent and these indexes did not grace any other segment.

"The sector went through some hard times but the shock must be positive because it injected a little more realism. The enterprises that are in trouble today will have to go out looking for solutions," said Luiz Eduardo Tornaghi, president of Acel Participacoes, with capital in five enterprises, one of which is in the data processing field; that is the Amplus company which produces local networks.

The Flag of the National Economic and Social Development Bank

The BNDE (National Economic and Social Development Bank) is a leader in the philosophy of mergers and takeovers. It has already held meetings with executives from SID, Labo, Itautec, EDISA [Digital Electronics, Inc.], Cobra, and the president of Abicomp in an effort to discuss ways of bringing these mergers about. "Business operators are turning out to be cautious and, such as we ourselves, do not know how this proposal can be put into practice," said Bank Vice President Andre Franco Montoro Filho without hesitation. In his opinion, mergers are inevitable. He emphasized that, if we listen to the nation's data processing industry from the microeconomic viewpoint, we might think of various mechanisms of capitalization, "but which would not solve any of the problems the sector is having in achieving its growth." As means of absorbing funds he listed the financing granted by the bank itself, by FINEP [Funding Authority for Studies and Projects], the support of the "venture capital" groups, the procurement of money through the stock exchanges (currently on the downgrade) or the use of foreign debt conversion into risk capital. He thinks that conversion can help but will not offer any major resources. This is because the federal government is planning to come up with between $1 million and $2 million at most by July of the coming year and everybody knows that priority goes to the exporting sectors and to the tourist industry. Montoro believes that these capitalization mechanisms can solve temporary economic crises but not the question at the microeconomic level. The strengthening of the sector, avoiding any duplication of activities, calls for a dispersion of funds. "With a smaller number of enterprises in the field, we would create more competitiveness, higher quality, and a larger production scale," he says.

The president of the SID summarizes Montoro's observations as follows: "It took the United States 80 years to build an outfit such as IBM; in just 10 or 15 years, Brazil wants to create several IBMs." And he adds: "There is no room for three enterprises operating in the microelectronic field or various groups producing the same equipment, getting in each other's way. All are

weakened regardless of whether they are big, middle-sized, or small enterprises."

Maintaining Averages

A respectable heavy-weight in the national economy, BRADESCO, which through the Digilab holding company works through nine data processing enterprises with a maximum participation of 50 percent of the capital--in other words, real "venture capital"--sees the question of the sector's strengthening from a different angle. Candido Leonelli, superintendent of the Digilab holding company, believes that the spread of the mentality of combined efforts and technological cooperation agreements between competing groups would certainly prevent duplication of activities. In his opinion mergers are not necessarily legally and operationally complicated and can generate the kind of avalanche which the area needs. Leonelli advocates the proliferation of sales in O&M. "That would mean eliminating those that do not have a specific product. This, by the way, is the strategy pursued by Digilab in dealing with the enterprise in which it participates; sales are handled by group or by market."

Carlos Rocha, president of TDA, a Sao Paulo enterprise that makes peripherals, and of Troppus, which manufactures supermicros, both of which are medium-sized enterprises, follows the line of thinking pursued by Digilab. "There is room for the medium-sized enterprises," he assured us. "The best example of that is the model of Japan where data processing grew through big, medium-sized, and small enterprises but always with a well-defined industrial policy. There was always integration into activities with some supplementing the activities of others. Everything was done intelligently, generating technology and competitiveness along the way. There was a strong government presence, there were well-planned funds, and the strategy was drafted in medium-range and long-range terms.

For the business operator the difficulty in organizing the national model basically involves the complete separation between government agencies: "The SEI [Special Secretariat of Informatics] is not charting a clear policy; the Ministry of Industry and Commerce is providing incentives for export areas while the Interior Ministry is strengthening the free zone of Manaus (by creating an electrical and electronic industry based on foreign technology, turning out expensive products whose sales are not well timed and which are produced with the help of fat tax incentives); the CACEX [Foreign Trade Department] does not provide any priority for importing high-tech equipment; the rates established by the customs policy commission conflict with the informatics policy and the BNDES itself is releasing funds based on real guarantees that are not always accessible to the medium-sized and small enterprises which in many cases are technology-intensive."

Mergers, takeovers, agreements on combined sales--these can be some of the ways out when it comes to strengthening domestic enterprises but the main concern is to spell out a clear and objective industrial policy.

Credibility Crisis

For executives of partnership enterprises, the informatics area needs to swing into action because right now it is facing a credibility crisis. This view is backed up by economists Francisco Lopes (see following report) in whose opinion the sector became weak during the first cyclic crisis which it faced, something which is quite common in the economy. "In Brazil, the data processing industry, which was established in a rather artificial atmosphere, cannot maintain itself in the long run. Many enterprises did not withstand the first shock; that is negative as far as they are concerned but it does not necessarily lead to ruin for society," remarked Luiz Eduardo Tornaghi. He says that ACEL participates only in the capital of enterprises which, after lengthy studies, showed that they are going to survive even if they go through their market reserve. He says that this is true of Amplus which is planning to go into the foreign market within 2 years.

Arbi Participacoes, which is involved in the purchase of Atlantic do Brasil, notes that it is "particularly interested in high-tech enterprises but investing is not a philanthropic activity; everything is a question of price and prospects of return," says Carlos Muniz, the group's vice president. Arbi is a partner in the capital of Lasertech of Campinas (13 percent), Opto Eletronica (35 percent), Engecer (which is beginning to turn out ceramic products, 36 percent), Digitel (8.5 percent), and 60 percent of D. R. Vasconcelos (optics, optronics, precision mechanics, and robotics). According to Muniz, the idea is to continue at this pace since the Brazilian data processing model inhibits investments in the sector: "Abroad, the funds spent on research and development aimed at new products are huge but that is not true here. This leaves the enterprises vulnerable and obsolescence is almost inevitable. The investor's risk is very high. Concentration of enterprises is inevitable. It becomes a question of survival," he warns.

Even Investec is going through a time of caution. The group shares in the capital of Labo (48.4 percent), Comsip Engenharia (36.6 percent), Meddidata (49.9%, which holds 23.5 percent of Elebra Computadores), and Digitel (4%). Luiz Spinola, director of market relations, says that the group is ready to invest, but cautiously: "We are aware that the country must master the advanced technologies and we are opting for high technology because this is how you make the most money. But this year we were surprised by negative performances. I think that the good business operator today must move very cautiously so as not to have to yield to the risk capital investor. We are ready to invest but we go through a very serious analysis and we are very cautious. This is even more true if we realize that government policy gives preference to financial undertakings that involve little risk while it penalizes the productive outfits."

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OBJECTIONS RAISED TO PRIVATIZATION OF BRAZIL'S EMBRATEL

Rio de Janeiro INFO in Portuguese Nov 87 p 16

[Text] After putting pressure on EMBRATEL [Brazilian Telecommunications Company] for two years, Victori Comunicacoes (Vicom), an enterprise of the Globo System and of the Bradesco group, came close to controlling a part of the data transmission service via Brasilsat, with spread spectrum technology, in data dissemination (transmission) and interactive (two-directional) modes.

Its objective was not attained only because the almost 10,000 employees at EMBRATEL reacted, charging breakup of monopoly and demanding cancellation of two contracts, signed on 14 October between the state company, Victori, and Moddata. According to the employees, this was to be the first step toward the return to private control of the enterprise in the communications service and would mean greater power for the Globo System which in addition to operating would also produce the service.

Although EMBRATEL president Cleofas Uchoa said that the agreements were worked out by technical teams from all enterprises, the Association of Employees of EMBRATEL assured us that it was not consulted. The agreements were signed in the office of President Pedro Jorge Castelo Branco Sampaio who left the enterprise to work in Washington.

The heaviest criticism is directed at Victori because, according to one official, the contract was ready when Moddata decided to participate. "It became clear to us that it was drafted by the enterprise of Mr Roberto Marinho and by the Communications Ministry," the official said.

According to the agreement, EMBRATEL would retain control over the master stations and the two enterprises would have the job of selling their equipment and installing the secondary stations with full freedom of coverage. One of the sharpest criticisms expressed by the officials had to do with the manner of payment since EMBRATEL, after investing about $200 million in the Brasilsat satellite, would each month receive from the enterprises 320 TBCD (Basic Data Communication Rate, whose unit is equivalent to 0.01531 OTNs) per secondary station, in the dissemination mode, and 700 TBCD in the interactive mode. According to calculations by Jorge Bittar, director of the National Federation of Engineers and Officials of the EMBRATEL, to create the private data transmission networks, the enterprises would invest only about $5

million. To him, this service is profitable for the state company and there are no financial reasons for it not to invest in the project all by itself. "Its costs represent only 0.5 percent of the annual investment of EMBRATEL and 2.5 percent of what was spent on Brasilsat," Bittar charged. Today about 16 out of 24 transponders (transmission channels) of Brasilsat are occupied and the enterprise has a second satellite in reserve.

During the discussions, one of the main doubts expressed by the officials had to do with the origin of Victori equipment. If the agreement had gone through, however, there is every reason to believe that it would have directly or indirectly introduced into Brazil the technology of the American enterprise Equatorial with which it is associated. According to its President Fernando Jardim, Moddata is only interested in selling and renting its equipment.

5058
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BRAZILIAN SPACE COOPERATION WITH USSR, PRC

San Jose dos Campos ESPACIAL in Portuguese May 87 p 11

[Text] In January 1987, a group of Brazilian researchers spent 9 days visiting the Soviet Union where they established various contacts with institutions and scientists in that country; the primary objective of this visit was to open ways toward scientific cooperation between Brazil and the USSR in the field of space sciences and meteorology. The visitors included INPE [National Institute of Space Research] General Manager Marco Antonio Raupp; National Meteorology Institute Director Antonio Divino Moura; INPE Director of Engineering and Space Technology Cesar Celeste Ghizoni; INPE Director of Space and Atmospheric Sciences Joao E. Steiner; and National Observatory (CNPq [National Council for Scientific and Technologic Development]) researcher Luiz A. Nicolaci da Costa.

The first result of this visit was the interest expressed by both sides in Brazilian participation in the Fobos Project to be carried out by the Soviet Union in 1988. As part of this project, which already includes the participation of various countries, the Soviets are trying to launch an unmanned spaceship for a 200-day voyage which, during that time, will for 30 days remain in the orbit of the Fobos satellite of the planet Mars, carrying out various research assignments.

The scientific experiments to be conducted in this spaceship will involve studies on the chemical and physical composition of Fobos, mapping the orbit of this satellite around Mars through VLBI (Very Long Baseline Interferometry) system, as well as studying the atmosphere and magnetosphere of Mars and the surface properties of the Fobos satellite.

Brazilian Participation

After initial contacts in January, three researchers from the INPE visited the Soviet Union for the purpose of spelling out Brazilian participation in space cooperation with the USSR. For 2 weeks in March 1987, researchers Jose Marques da Costa, head of the Department of Geophysics and Aeronomy, Walter Demetrio Gonzalez Alarcon and Mangalathayil Ali Abdu, both from that same department, visited the IKI (Space Research Institute) and the Institute of Earth Magnetism, Ionosphere, and Radio Propagation (Izmiran)--both under the

Academy of Sciences USSR--and the Committee on Hydrometry and Environmental Controls.

With the cooperation of various Brazilian institutions concerned, the INPE will participate in the Fobos Project through an analysis of data from Fobos and Mars, simultaneous observation of the sun, celestial navigation and mechanics of Fobos for the purpose of mapping its orbit and movements through VLBI, plus the optical identification of gamma ray sources.

At the end of the first quarter of 1987, the INPE sent two proposals to the USSR for participation in experiments in the mission which the Soviets will conduct to Mars in 1992. Primary interest in this participation has to do with measurements of radon on board the spaceship with equipment already developed by the INPE and tested at various points throughout Brazilian territory and in the Antarctic. The other activity has to do with the analysis of ions, using the mass spectrometer of the quadrupolar type in the atmosphere of Mars. This experiment will be carried out jointly by the INPE and by the ITA (Technological Institute of Aeronautics) and the CTA (Technical Aerospace Center).

In addition to these two proposals, the INPE is interested in jointly investigating the magnetosphere and ionosphere of Mars through measurements to be defined by the end of this year.

Space Cooperation with China

Between 8 and 21 February of this year, and INPE mission conducted important technical discussions with various space research institutions during a visit to the PRC. In Beijing, the Brazilian group met with representatives of the CAST (Chinese Space Technology Academy), an organization of the Ministry of Astronautics, and institutions of the Academy, such as the Institute of Satellite Systems Engineering, the Institute of Control Engineering, the Institute of Environmental Tests, and the Satellite Factory.

Discussions with CAST related to the participation of the INPE in the project for the development of the Chinese remote sensor satellite to be launched in 1991. The INPE will be able to supply some subsystems for the satellite, such as data collection and telemetry transponders. Also analyzed was the possibility of testing the payload of the Brazilian earth observation satellite on board the Chinese satellite and the implementation, by the INPE, of image reception and processing stations for the remote sensor satellite of that country.

Other conversations had to do with the participation of the CAST in the MECB through the supply of components, systems, and technology transfer in areas such as micropropulsion and inertial platform components (floating gyros). The INPE mission--consisting of General Manager Marco Antonio Raupp, plus MECB [Complete Brazilian Space Mission] directors and managers--also visited the Radio Engineering Institute in X'iang and the Satellite Engineering Institute in Xanghai.

A proposal for cooperation between the INPE and the CAST was signed as a result of the conversations in China. These understandings will have to be firmed up following the visit by a Chinese mission to the INPE during the first half of 1987.

5058
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BRAZIL'S SMAR MAY SELL AUTOMATION EQUIPMENT TO CUBA

Rio de Janeiro O GLOBO in Portuguese 16 Nov 87 p 19

[Text] Sertaozinho, SP [San Paulo]--SMAR, the biggest Latin American enterprise in the field of digital electronic instruments for process control, established in 1974 in Sertaozinho, produces more than 40 items and decided to embark on an effort to win international markets; after establishing SMAR International, which set up an office in New York, the enterprise seeks to sell about $2 million (120 million Cruzados) of equipment to Cuba as the start of a program which will be paralleled by technology transfer.

In the beginning, SMAR will establish an office in Cuba to help the country master this technology. During a second stage, Cuba could make industrial process control equipment and export it to countries of the socialist bloc on a large scale.

Jose Silvio Martinelli, director of the Sugar and Alcohol Division of SMAR Equipment, admitted that the sector must show that it is strong following the data processing restriction law. To win markets in Cuba, the enterprise only needs a line of financing from the Federal Government because, during a congress of sugar producers from Central America and Latin America, in the Caribbean in October, Cuban technicians displayed interest in the sophisticated automatic control line of the Brazilian sugar and alcohol industry. But there is one problem: In its transactions with other countries, Cuba wants a term of 360 days to pay. Japan, for example, grants a term of as much as 720 days for the payment of some equipment items.

"We are asking the Brazilian government for a line of credit to finance this export effort because the enterprise is unable to wait one year for its money," explained Martinelli.

The SMAR has confidence in its products which are turned out specifically for use in the production of sugar and alcohol and which, like Japanese equipment items, do not require adaptation. Electronically speaking, the Brazilian equipment was programmed to withstand high temperatures and the operating and maintenance manuals are written in Portuguese and Spanish to help the Cubans understand them. In addition, SMAR has established a personnel training facility at its pilot plant and even in the Brazilian plants which are already using its equipment.

SMAR also produces equipment for other sectors; these include the areas of petrochemistry, the steel industry, minerals, the chemical industry, the textile industry, and the food industry. In the sugar and alcohol sector, it produces equipment for the automation of milling, burning control, draft and level control systems for boilers, for the distillation column, and control of acidity and quantity of sugar in the syrup.

5058
CSO: 3699/0024

BRIEFS

BRAZILIAN PARTICIPATION IN 'INFORMATICA CUBA 88'--Between 15 and 21 February of next year, Brazil will participate in "Informatica Cuba 88" in Havana; the participation of Cobra Computadores S/A Scopus, and Edisa [Digital Electronics, Inc.] has already been assured. This is the first time that the Cuban government is promoting a major international event in the field of data processing. The main purpose of "Informatica Cuba 88" is to concentrate not only on the purely technical aspects but also on the political and commercial facets of the influence exerted by data processing on the development of Latin American continent. In this context, it will be necessary to discuss policy strategies for the dissemination of data processing in Latin America in the light of the experiences of Brazil, Argentina, Mexico, and Cuba. According to its international coordinating committee, "Informatica Cuba 88" will include five simultaneous events. Here they are: The International Conference on Applications in Data Processing, the International Conference on Medical Data Processing, the International Conference on Software Problems, the 13th Latin American Meeting of Data Processing Users, and the International Data Processing Fair. [Text] [Brasilia BRASIL CIENCIA in Portuguese Oct 87 p 6] 5058

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T6

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